ICFIS 2017

10th International Conference on Forensic Inference and Statistics

Conference Program

September 5-8, 2017
University of St. Thomas
Minneapolis, MN

UNIVERSITY OF St.Thomas

BUILDINGS & SPACES
▲ Accessible Building
♦ Partially Accessible Building

Opus Hall (MOH)..▲ 1
  School of Education
Terrence Murphy Hall (TMH).....................▲ 2
  College of Business
Schulze Hall (SCH) ....▲ 3
  Schulze School of Entrepreneurship
School of Law (MSL)....................................▲ 4
Parking at 11th Street and Harmon Place..▲ 5
MacPhail...▲ 6

KEY

T	Metro Transit Bus Stop
P	Public Hourly Parking
●	Restricted Parking
🚌	St. Thomas Shuttle Stop
▨	Academic
▨	Parking

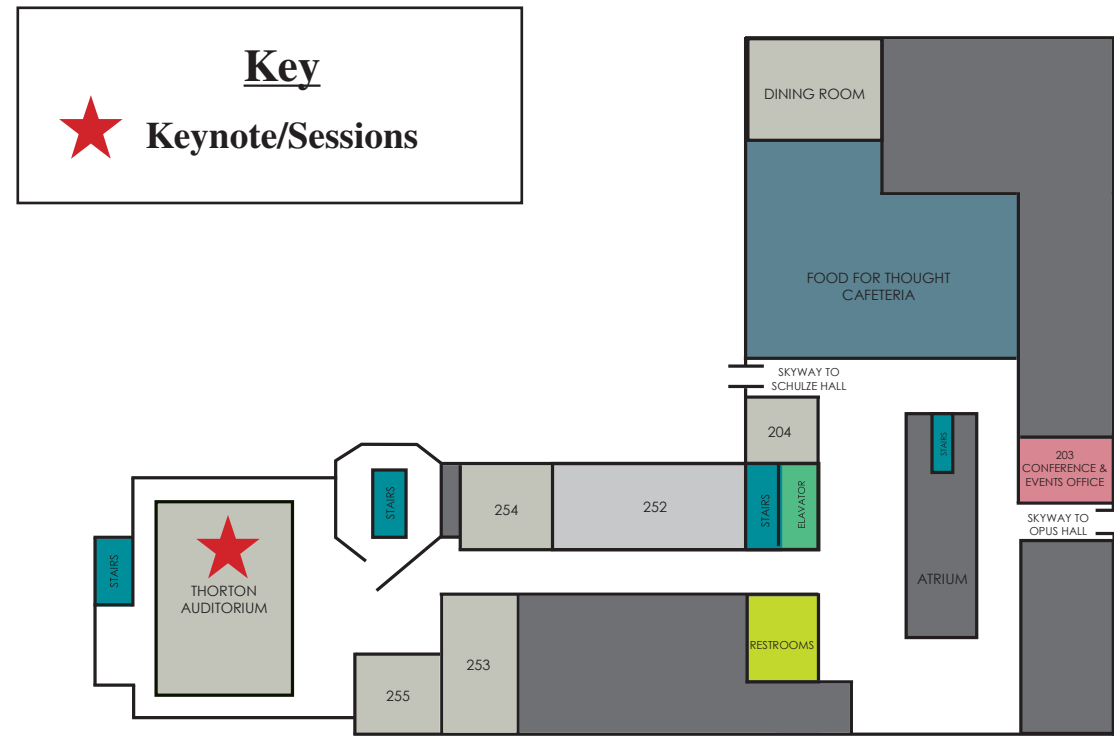Produced by the University of St. Thomas-Minnesota. Updated March 2016.
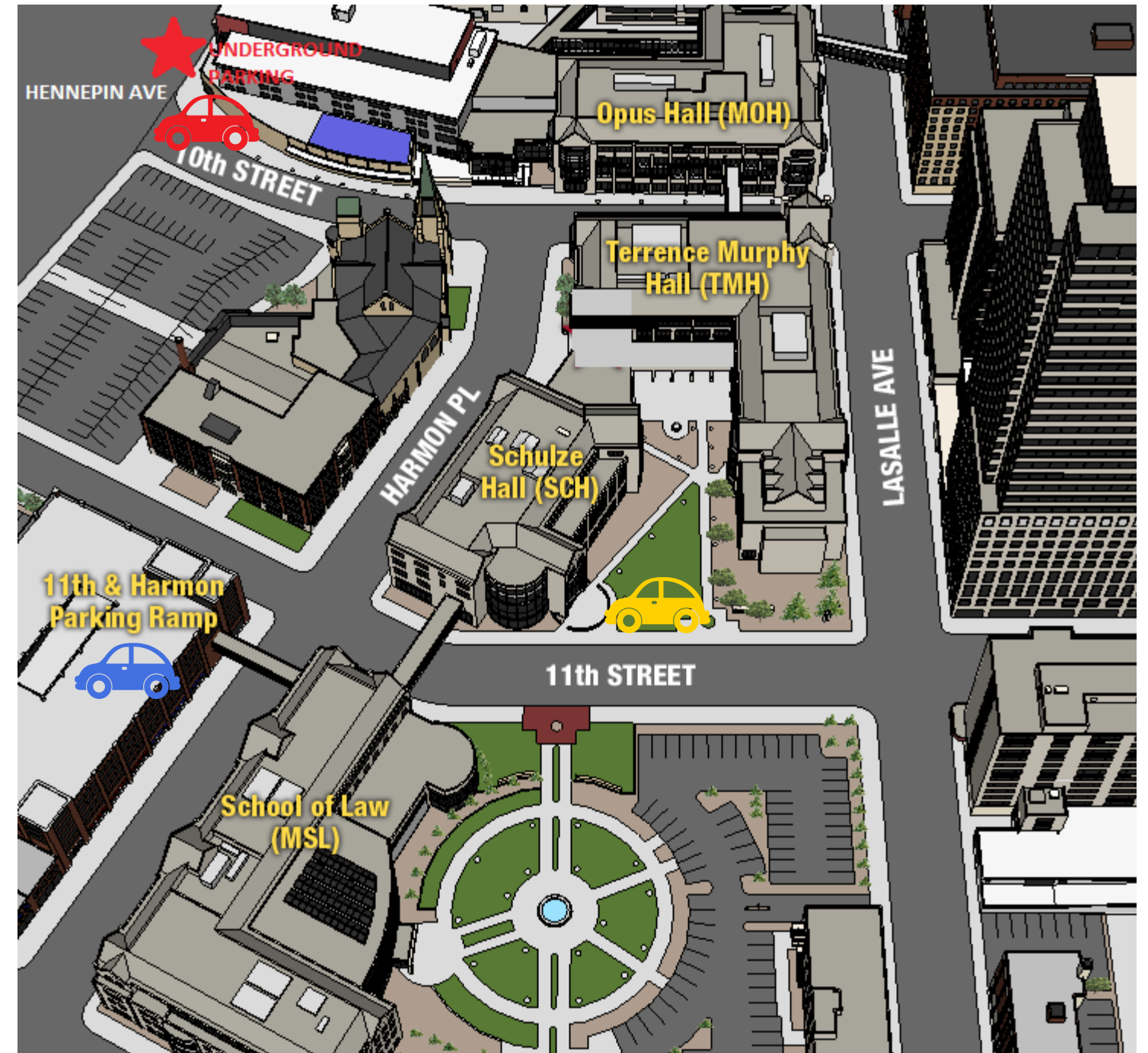
KEY

11th St. & Harmon Parking RAMP: 12 - 24 hrs $10.50	Shuttle Bus to Walker Art Center	Hennepin Ave. & 10th St. Underground Parking: 12 - 24 hrs $13

Terrence Murphy Hall | Level Two

Key

★ Keynote/Sessions

DINING ROOM

FOOD FOR THOUGHT
CAFETERIA

SKYWAY TO
SCHULZE HALL

204

203
CONFERENCE &
EVENTS OFFICE

SKYWAY TO
OPUS HALL

254   252   STAIRS   ELAVATOR

STAIRS

ATRIUM

★ THORTON
AUDITORIUM

STAIRS

RESTROOMS

253

255

Opus Hall | Level Two

Key

★

Meals, Sessions,
& Poster Session

SKYWAY TO TARGET STORE

ELAVATOR

RESTROOMS

SECURITY

STAIRS

ELEVATOR

SKYWAY
ENTRANCE

Registration/
Check-in

STAIRS

202   201
THE GREAT ROOM

SKYWAY TO
TERRENCE
MURPHY HALL

★   ★

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**SOUTH DAKOTA
STATE UNIVERSITY**

July, 2017

Dear Attendees,

As President of the South Dakota State University, I welcome you to the 10th International Conference on Forensic Inference and Statistics. The Mathematics and Statistics Department at SDSU is proud to have been selected to organize this conference and to be recognized as a leader in the application of statistical science in the forensic and legal fields.

During the past 30 years, this conference has been instrumental in bringing scientists and legal scholars together to identify the shortcomings in the logical and inferential processes used in forensic science and address the challenges raised by different scientific, legal and political bodies around the world. The ICFIS program also provides a unique opportunity for scientists, legal scholars and stakeholders to meet and discuss novel solutions to improve and strengthen the scientific foundations of forensic science, and foster future collaborations aimed at gathering, analyzing, interpreting and communicating forensic evidence.

I am particularly pleased to note the emphasis the committee has placed on encouraging young scientists to present their research projects, working with sponsors to support their attendace to the conference and promoting their work.

Best wishes for a great conference.

Sincerely,

Barry H. Dunn

Barry H. Dunn, Ph.D.
President
South Dakota State University

Sponsors

SOUTH DAKOTA STATE UNIVERSITY

Nametags
Please keep your nametags on at all times while accessing conference services or sessions.

Updates
All program updates and messages will be posted on the main page of the ICFIS 2017 website. Please check daily for cancellations and other important information. www.sdstate.edu/ICFIS

Registration/Check-in Hours
Located at the University of St. Thomas in the Opus Hall Atrium
Tuesday, September 5   1:00 pm – 5:00 pm
Wednesday, September 6   7:00 am – 12:00 pm
Thursday, September 7   7:00 am – 12:00 pm

On Campus Dining
All meals will be at the University of St. Thomas in the Opus Hall Atrium. All meals are included as part of your registration fee. Other campus options are listed below:

Food for Thought
Terrence Murphy Hall 2nd floor
Mon. – Thurs. 7:30 am – 8:00 pm; Friday 7:30 am – 3:00 pm
Accepts cash, check, credit or debit card.
www.stthomas.edu/dining/locations/minneapoliscampus/

Off Campus Dining
Starbucks
1101 Lasalle Ave, Minneapolis, MN 55403 – 1 block from University of St. Thomas

Nicolett Mall
The heart of downtown Minneapolis is being transformed with the complete redesign of Nicollet Mall, part of the Minneapolis Big Build. By late 2017, all 12 blocks of the Mall will be rebuilt, making it an even greener, more inviting place to shop, dine, or explore the project's captivating new art installations. Take in some jazz, see the orchestra or take a walk down the Mall to the Mississippi River.

505 Nicollet Ave #100, Minneapolis, MN 55402 – Approx. half a mile from University of St. Thomas
www.minneapolis.org/things-to-do/shopping/nicollet/

Downtown Dining
With dozens of international culinary traditions, locally sourced "farm to table" restaurants and chefs with James Beard Award wins and nominations, it's no surprise Minneapolis is the winner of USA Today/10Best.com's Best Local Food Scene 2015. Find out why foodies are taking note.
www.minneapolis.org/restaurants/

Parking
Parking ramps are available around the University of St. Thomas campus. There are no free parking lots/spots available.
11th & Harmon; 12-24 hours = $10.50
Hennepin Ave. & 10th St.; 12-24 hours = $13

Internet
Complimentary Wi-Fi available for all attendees. Please select "UST-OPEN" as the network. No password required.

Health
For emergencies, call 911
Emergencies from a campus phone, call 5555
Non-emergencies, call 651-962-5100

Hennepin County Medical Center
701 Park Ave, Minneapolis, MN 55415
Open 24 hours
Phone: (612) 873-3000

Transportation
Workshops
Shuttle bus service provided to and from the Minnesota Bureau of Criminal Apprehension. Bus departs from the University of St. Thomas for both workshops. View the session schedule for departure times.

Walker Art Center
Shuttle bus service provided to and from the Walker Art Center. Bus departs from the University of St. Thomas. View the session schedule for departure times.

Taxi
Blue and White Taxi
612-333-333
www.blueandwhitetaxi.com/services/

Uber
Download the Uber app to book your ride

Super Shuttle
Book airport rides or any ride around town.
800-258-3826
www.supershuttlec.om

Additional transportation options can be found by visiting www.minneapolis.org/map-transportation/light-rail-and-bus-schedule/

ATM
US Bank ATM located in Terrence Murphy Hall 2nd floor

Printing Services
On Campus
Please see the Registration/Check-in table for any printing needs you have. Charges do apply.

FedEx Office Print & Ship Center
1001 S Marquette Ave, Minneapolis, MN 55403 – Approx. a quarter mile from University of St. Thomas

Questions
For any questions or concerns, please email us at sdsu.seminars@sdstate.edu or visit the Registration/Check-in table in the Opus Hall Atrium.

Time	Workshop 1: Elements of Forensic Science	Workshop 2: Communicating Forensic Evidence	Registration
7:30 - 8:30	Transportation from University of St. Thomas (1000 LaSalle Ave., Minneapolis, MN 55403) to Minnesota Bureau of Criminal Apprehension provided **Departure Time:** 7:45 **Bus Departure Location:** South of Terrence Murphy Hall on 11th St.		
8:30 - 12:00	**Workshop 1** Elements of forensic science for statisticians **Location:** Minnesota Bureau of Criminal Apprehension 1430 Maryland Ave. E, St Paul, MN 55106 (Transportation from University of St. Thomas to Minnesota Bureau of Criminal Apprehension provided. Lunch is on your own.)		
12:00 - 12:45	Transportation from Minnesota Bureau of Criminal Apprehension to University of St. Thomas provided **Departure Time:** 12:05 **Bus Drop Off Location:** University of St. Thomas South of Terrence Murphy Hall on 11th St.		
12:45 - 13:30		Transportation from University of St. Thomas (1000 LaSalle Ave., Minneapolis, MN 55403) to Minnesota Bureau of Criminal Apprehension provided **Departure Time:** Bus departs at 12:45 **Bus Departure Location:** South of Terrence Murphy Hall on 11th St.	
13:30 - 17:00		**Workshop 2** Forum on communicating qualitative and quantitative evidence in forensic science **Location:** Minnesota Bureau of Criminal Apprehension 1430 Maryland Ave E, St Paul, MN 55106 (Transportation from University of St. Thomas to Minnesota Bureau of Criminal Apprehension provided)	**Registration** **Location:** University of St. Thomas 1000 LaSalle Ave., Minneapolis, MN 55403 Opus Hall Atrium **Time:** 13:00 - 17:00

Time	Workshop 1: Elements of Forensic Science	Workshop 2: Communicating Forensic Evidence	Registration
17:00 - 17:45		Transportation from Minnesota Bureau of Criminal Apprehension to University of St. Thomas provided **Departure Time:** 17:05 **Bus Drop Off Location:** University of St. Thomas South of Terrence Murphy Hall on 11th St.	

Time	Thorton Auditorium (Terrence Murphy Hall)	Great Room 201 (Opus Hall)	Great Room 202 (Opus Hall)
7:00 - 12:00	Registration (Location: Opus Hall Atrium)		
7:00 - 8:00	Breakfast		
8:00 - 8:15	Opening Ceremony		
8:15 - 9:00	**Keynote:** Brendan Max - Reforming Forensics: What are the odds we do it and get it right?		
9:00 - 10: 15	Session 1 - Chair: **Jessie Hendricks** **Foundations** Colin Aitken - Statistical significance - meaningful or not? Alex Biedermann - A formal approach to qualifying and quantifying the 'goodness' of forensic identification decisions	Session 2 - Chair: **Lotem Kaplan** **Bayesian network - Activity/combining evidence** Simone Gittelson** - What the two-trace problem teaches us about DNA mixture interpretation Jacob de Zoete** - Modeling complex legal cases as a Bayesian network (BN) using idioms and sensitivity analysis with the Collins case as a complete example	Session 3 - Chair: **Anjali Gupta** **Application to specific evidence type - Firearms** Nicholas Petraco - Algorithmic toolmark identification: lessons learned from a decade of data collection, feature extraction and statistical analysis Heike Hofmann - Matching bullet lands under degradation
10:15 - 10:45	Break	Break	Break
10:45 - 12:00	**Foundations** Larry Tang - Likelihood ratios in forensics: what they are and what they are not Peter Vergeer - Several approaches to the LR: which is better?	**Bayesian network - Activity/combining evidence** Jacob de Zoete** - Automatic generation of Bayesian networks in forensic science Jan de Koeijer - Combining forensic evidence in complex cases	**Application to specific evidence type - Firearms** Semhar Michael** - Use of finite mixture models in bullet identification problem Haley Jeppson** - Online x3p Viewer
12:00 - 13:00	Lunch Break (Lunch speaker: Colin Aitken - History of ICFIS)		
13:00 - 14:15	Session 4 - Chair: **Danica Ommen** **Foundation - Score-based LR** Peter Vergeer - LRs from score based likelihood ratio systems are often based on extrapolation: when to stop extrapolating? Austin O'Brien** - A kernel based approach to determine atypoicality	Session 5 - Chair: **Amanda Luby** **Bayesian network - Activity/combining evidence** Charles Berger - Even more on the hierarchy of propositions: activity level propositions addressing the actor or the activity Anjali Mazumder - Using Chain Event Graphs for assessing asymmetric evidence	Session 6 - Chair: **Kira Antell** **U.S. DOJ Special session: Communicating evidence** Kira M. Antell - Session I Repeated in Session II
14:15 - 14:45	Break	Break	Break
14:45 - 16:00	**Foundation - Score-based LR** Jessie Hendricks** - Approximate Bayesian computation in forensic science Douglas Armstrong** - The development of a kernel-based method for model selection with example of an application to a forensic problem	**Application to specific evidence type - QD/Bloodstain** Ya-Ting Chang** - Evidence evaluation and functional data analysis Lotem Kaplan** - Bloodstain: A new framework for analysis	**U.S. DOJ Special session: Communicating evidence** Kira M. Antell - Session II Repeat from Session I

Time	Thorton Auditorium (Terrence Murphy Hall)	Great Room 201 (Opus Hall)	Great Room 202 (Opus Hall)
16:00 - 17:15	**Memorial Invited Session: Remembering Stephen E. Fienberg** Alicia Carriquiry, WIlliam Eddy, Karen Kafadar, Hal Stern - *Remembering Stephen Fienberg* Xiao-Hui Tai and William Eddy - *Determining unique sellers on online anonymous marketplaces* Christopher Galbraith** and Padhraic Smyth - *Statistical analyses of user-even data in a digital forensics context* Soyoung Park**, Alicia Carriquiry and Hari Iyer: *Toward a score-based approach to compare shoe sole impressions.* Alice Liu**, Fabian Zemp, Madeline Ausdemore, Henry Koertner and Henry Swofford - *An overview of FRStat* Neil Spencer** and Jared Murray - *Modeling the distribution of randomly acquired characteristics in footwear evidence*		
18:00 - 21:00	**Social event** Meet and Greet Poster Session Dinner **Location:** The Great Room 201 & 202 at Opus Hall		

Meals are in the Great Room 201/202 at Opus Hall
Keynote and special sessions are in
Thorton Auditorium at Terrence Murphy Hall
**Competing for the Young Investigator Award

Time	Thorton Auditorium (Terrence Murphy Hall)	Great Room 201 (Opus Hall)	Great Room 202 (Opus Hall)
7:00 - 12:00	Registration (**Location**: Opus Hall Atrium)		
7:15 - 8:15	Breakfast		
8:15 - 9:00	**Keynote:** Julia Mortera - *Paternity testing and other inference about relationships from DNA mixtures*		
9:00 - 10:15	Session 1 - Chair: **Ciaran Evans** **Application to specific evidence type - DNA mixtures/validation** James Curran - Is probabilistic genotyping ready for prime-time? Hannah Kelly - Are large reference datasets useful for the validation of probabilistic genotyping software?	Session 2 - Chair: **Madeline Ausdemore** **Application to specific evidence type - Trace** Josh Dettman - Forensic discrimination of Copper wire using trace element concentrations Karen Pan** - Statistical modeling and analysis of trace element concentrations in forensic glass evidence	Session 3 - Chair: **Neil Spencer** **Causality / Communication** Maria Cuellar** - Causes of effects and effects of causes: a study of shaken baby syndrome Philip Dawid - Improved bounds for the probability of causation
10:15 - 10:45	Break	Break	Break
10:45 - 12:00	**Application to specific evidence type - DNA mixtures/validation** Maarten Kruijver** - A novel approach to empirical validation of LRs in DNA mixture interpretation Keith Inman - Comparison of open source software for assessing the weight of evidence	**Application to specific evidence type - Trace** Patrick Buzzini - A kernel-based method for the classification and quantification of the weight of evidence of textile fibers analyzed by microspectrophotometry (MSP). Grzegorz Zadora - The use of multiblock PCA within the hybrid likelihood ratio models for interpretation of highly multidimensional data	**Causality / Communication** William Thompson - Lay perceptions of the strength of source conclusions
12:00 - 13:00	Lunch Break		
13:00 - 14:15	Session 4 - Chair: **Xiaochen Zhu** **Application to specific evidence type - DNA mixtures** Mark Perlin - Forensic match information: exact calculation and applications Amke Caliebe - Likelihood ratios for an unknown number of contributors	Session 5 - Chair: **Douglas Armstrong** **Application to specific evidence type - Trace** Madeline Ausdemore** - Applications of latent dirichlet allocation (LDA) techniques to mixtures of dust particles Grzegorz Zadora - The hybrid likelihood ratio models for verifying the origins of the wolframites	Session 6 - Chair: **Ya-ting Chang** **Foundations** Geoffrey Morrison - Statistical procedures intended to avoid overestimating the strength of forensic evidence Danica Ommen** - Recent developments on a distributional quantification for the Likelihood Ratio
14:15 - 14:45	Break	Break	Break

Time	Thorton Auditorium (Terrence Murphy Hall)	Great Room 201 (Opus Hall)	Great Room 202 (Opus Hall)
14:45 - 16:00	**Application to specific evidence type - Handwriting** Mark Lancaster - Open-Source Methods for Forensic Document Examination Hal Stern - Characterizing handwriting complexity for forensic evaluations	**Application to specific evidence type - Trace** Anjali Gupta** - Dimensionality Reduction of LIBS Data for Bayesian analysis Amy Wilson - Distribution of cocaine on banknotes in general circulation in England and Wales	**Foundations** Cor Veenman - Likelihood ratios from quasi posterior odds Ted Vosk - Metrology: The epistemology of forensic measurements
16:00 - 17:15	**Invited special session to honor Colin Aitken's work** Marjan Sjerps and Franco Taroni - *Introduction* Franco Taroni - *Relaxing the assumption of a direct person-source relationship in the evaluation of scientific findings given activity level propositions* Anders Nordgaard - *Classification of percentages in seizures of narcotic material.* Silvia Bozza - *Statistical issues in the assignment and reporting of Bayes factor for multivariate evidential data.* *Joseph Gastwirth - Some final thoughts*		
18:30 - 19:00	Transportation from University of St. Thomas to Walker Art Center provided **Departure Times:** 18:30 & 19:00 **Bus Departure Location:** South of Terrence Murphy Hall on 11th St.		
19:00 - 22:00	**Social Event** Walker Art Center **Location:** 725 Vineland Place, Minneapolis, MN 55403 Skyline Room, 5th floor Heavy hors d'oeuvre and cash bar. Bring name badge for entrance into facility. Complimentary pass to walk around center included. Valid week of conference up to a year. Underground parking available for daily rate of $5		
20:30 - 22:30	Transportation from Walker Art Center to University of St. Thomas **Departure Times:** 20:30, 21:00, 21:30, 22:00, 22:30 **Bus Drop Off Location:** South of Terrence Murphy Hall on 11th St.		

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Keynote and special sessions are in
Thorton Auditorium at Terrence Murphy Hall
**Competing for the Young Investigator Award

Time	Thorton Auditorium (Terrence Murphy Hall)	Great Room 201 (Opus Hall)	Great Room 202 (Opus Hall)
7:00 - 13:00	Luggage Check (**Location**: Opus Hall Atrium)		
7:15 - 8:15	Breakfast		
8:15 - 9:00	**Keynote:** Jane Hutton - *Expert evidence: civil law, epidemiology and data quality*		
9:00 - 10: 15	Session 1 - Chair: **Maria Cuellar** **Errors / Error rates** Jonathan Koehler - The case for Type II proficiency testing in forensic science Amanda Luby - Proficiency testing of fingerprint analysts: a Bayesian approach	Session 2 - Chair: **Cami Fuglsby** **Application of statistics to civil litigations** Joseph Gastwirth - Some recurring statistical issues in analyzing data in equal employment cases Qing Pan - Statistical procedures for assessing the need for an affirmative action plan: a reanalysis of the Shea v. Kerry case	
10:15 - 10:45	Break	Break	
10:45 - 12:00	**Errors / Error rates** Marjan Sjerps - Dealing with errors and adventitious matches in forensic DNA Simon Cole - How do forensic practitioners report pattern recognition results in the United States?	**Application to specific evidence type - Others** Jennifer Newman - StegoDB: A dataset for detecting mobile phone steganography Anjali Mazumder - Flies, damned flies & statistics: Functional domain selection for post-mortem interval estimation in forensic entomology	
12:00 - 12:15	Goodbyes and Farewell		

Meals are in the Great Room 201/202 at Opus Hall
Keynote and special sessions are in
Thorton Auditorium at Terrence Murphy Hall
**Competing for the Young Investigator Award

Located in Thorton Auditorium at Terrence Murphy Hall

Prof. Jane Hutton - University of Warwick, Warwick, UK

Professor Jane Hutton works in medical statistics, with special interests in survival analysis, meta-analysis and non-random data. Her methodological research largely focuses on developing models to answer questions raised by health care colleagues, and patients. Professor Hutton has major collaborations in cerebral palsy and epilepsy. Professor Hutton has written on ethics and philosophy of statistics, in response to challenges arising from medical research, legal work and discussions with statistical colleagues and philosophers.

Professor Hutton's research has informed her work in legal cases. She has provided more than 200 expert witness reports. The majority were on life expectancy of people with neurological injuries. She has also prepared reports on the adverse effects of drugs, and the success or failure of metal-on-metal hip joints. Expert witness reports have been provided for cases in Australia, Canada, Eire, Hong Kong, South Africa and the four countries of the United Kingdom. She is a member of the Royal Statistical Society Statistics and the Law section committee.
Website: go.warwick.ac.uk/jlhutton

Mr. Brendan Max - Cook County Public Defender Office, Chicago, IL

Brendan is the Chief of the Forensic Science Division of the Cook County Public Defender Office. The Forensic Science Division consists of 8 attorneys who are specially trained to evaluate and litigate forensic evidence in criminal cases. Brendan also provides training to defense attorneys around the country on evaluating and litigating forensic evidence. Brendan is a former member of the Homicide Task Force in the Cook County Public Defender Office, where he represented indigent citizens charged with capital murder. Brendan has tried dozens of jury trials in his 20-year career in criminal defense.

Prof. Julia Mortera - University of Roma Tre, Rome, Italy

Julia Mortera is a professor of Statistics at the University Roma Tre. She was a Simons Foundation visiting fellow at the Isaac Newton Institute, University of Cambridge 2016 for the scientific program on Probability and Statistics in Forensic Science; she is a committee member of the Royal Statistical Society Section "Statistics and the Law", a member of the Publications Network of Advisors of the Royal Statistical Society and a member of the Advisory Board for the Forensic Science Center of Excellence CSAFE.

She is an associate editor of "Bayesian Analysis". She was the chair of the organization committee of the "Fifth International Conference on Forensic Statistics", Venice, August 2002.

Her current research interests are related to forensic statistics, in particular the use of probabilistic expert systems for forensic identification using genetic markers, analysis of evidence, Bayesian networks, decision theory, game theory using Bayesian networks, and Bayesian statistics.

Located in Thorton Auditorium at Terrence Murphy Hall

Invited Special Session To Honor Colin Aitken's Work

Organizers: Marjan Sjerps (NFI) and Franco Taroni (UNIL)

The first edition of the International Conference on Forensic Inference and Statistics held in Edinburgh in 1990. It was organized by Colin Aitken and some closed friends as Ian Evett and David Kaye. At that time, Colin was Senior Lecturer in Statistics at the University of Edinburgh, Scotland. In the forensic domain, Colin was known for having published papers in the '80 concerning the use of statistics in forensic science and participated in numerous conferences around the world with the objective to sensibilize scientists and jurists to an aspect that was still receiving scarce attention, the interpretative. Throughout presentations, papers and the early two books, he tried to convince people that there is no form of scientific evidence whose interpretation is so definite that probabilistic treatment is not needed or desirable. Colin always supports a scientific vision in the hope that firmer lines of reasoning replace the arbitrary justifications upon which many evaluations rest in the practice of forensic science.

Despite his recent retirement, Colin is still very active, exploring new lines of research and finishing a new edition of his famous primer on statistics and the evaluation of evidence for forensic scientists.

To honor Colin's work, we would like to dedicate him a session where three young researchers will present their experience under Colin's supervision and collaboration.

The session is focused on three important aspects of Colin's work: (1) Theory, (2) Forensic Practice, and (3) Communication.

Located in Thorton Auditorium at Terrence Murphy Hall

Memorial Invited Special Session: Remembering Stephen E. Fienberg

Organizers: Alicia Carriquiry, William Eddy, Karen Kafadar, Hal Stern (CSAFE)

Stephen Elliott Fienberg passed away on December 14, 2017, shortly after turning 74 years of age. Steve's death was a tremendous loss for statistics and for science in general, and we will miss him sorely.

Steve was born in Toronto, Canada, on November 27, 1942. He obtained a degree in Mathematics from the University of Toronto in 1964, and a PhD in Statistics from Harvard University in 1968. He held faculty and administrative positions in the University of Chicago, the University of Minnesota, York University, and finally in Carnegie Mellon University where Steve worked for over 30 years.

Steve's passion was to advance the principled and constructive use of statistics to solve real problems in other disciplines, preferably when those problems had a public policy implication. Eric Lander, the co-Chair of President Obama's Council of Advisors on Science and Technology (PCAST), referred to Steve as a public statistician for his many and important contributions to science and policy.

Statistics and its application in forensic sciences were areas of tremendous interest for Steve. He was a pioneer in the field and was already publishing on this topic in the 1980s. He was an organizer and promoter of the earlier ICFS and encouraged students and colleagues to get involved in research in forensic statistics.

When NIST announced a competition for funds to establish a Center of Excellence in Forensic Statistics, Steve recruited Hal Stern, Karen Kafadar and me to submit a proposal. The proposal was funded, and CSAFE (Center for Statistics and Applications in Forensic Evidence) was established in 2015. Steve was instrumental in getting CSAFE off to a great start and in setting high expectations in terms of the quality and creativity of the research that is conducted at CSAFE.

Steve was an affectionate and loyal friend, and he was immensely patient with young faculty and students, and with anyone who was really trying. He was proud of every one of his students and continued in contact with most of them over the years.

In honor of Steve's memory and of his life-long dedication to mentoring young scientists, this session highlights the work of five young researchers in CSAFE.

Stephen E. Fienberg CSAFE Young Investigator Award

Stephen E. Fienberg CSAFE Young Investigator Award

The Stephen E. Feinberg CSAFE Young Investigator Award rewards and encourages excellence in forensic statistics at an early stage of career development, as personified by the late Stephen E. Fienberg. This award is determined based on the sessions and lectures delivered at the 10th International Conference on Forensic Inference and Statistics.

The awarded posters or lectures should demonstrate originality, creativity, depth of research, innovation, new methodologies, research design, and significance to the field and/or potential impact. Candidates must be young investigators (students at any level or scientists within five years of their terminal degree) and present in-person. The selection committee, comprised of CSAFE affiliates and members of the ICFIS Committee, will review the posters on display at the conference, attend the lectures, and, at the conclusion of the presentations, select up to three young investigators to receive the award. This award is supported by the Center for Statistics and Applications in Forensic Evidence (CSAFE) in order to honor the legacy of Stephen E. Fienberg and his contributions to the field. Learn more about CSAFE by visiting: forensicstats.org.

The Stephen E. Fienberg CSAFE Young Investigator Award will be awarded on Thursday, September 7 at the Social Event at the Walker Art Center.

Stephen E. Fienberg CSAFE Young Investigator Travel Award

This award is supported by the Center for Statistics and Applications in Forensic Evidence (CSAFE). Young investigators (students at any level or scientists within 5 years of their terminal degree) were encouraged to apply. Award winners are required to present a poster or an oral paper at the conference.

Congratulations to all of our recipients!
Ausdemore, Madeline - South Dakota State University
Baldaino, JenaMarie - Federal Bureau of Investigation Laboratory (Visiting Scientist)
Chang, Ya-ting(Sabrina) - University of Edinburgh (Scotland)
Cuellar, Maria - Carnegie Mellon University
Evans, Ciaran - Carnegie Mellon University
Fuglsby, Cami - South Dakota State University
Gupta, Anjali - University Of Auckland (New Zealand)
Hendricks, Jessie - South Dakota State University
Kaplan, Lotem - Carnegie Mellon University
Luby, Amanda - Carnegie Mellon University
Andersen, Mikkel M - Aalborg University and University of Copenhagen (Denmark)
Ommen, Danica - South Dakota State University
Spencer, Neil - Carnegie Mellon University
Zhu, Xiaochen - George Mason University

List of Posters

POSTER SESSION
Wednesday, September 6
The Great Room 201/202 at Opus Hall
6 - 9 pm

Baldaino, JenaMarie
Characterization of Aluminum Powders in Explosives Utilizing Particle Micromorphometry

Basulto-Elias, Guillermo
Shoe matching based on image cross-sectioning

De March, Ilaria**
Combining evidence and decision analysis in a casework involving bloodstain traces

De March, Ilaria**
Bayesian networks for combining dental and skeletal evidence in age estimation of living persons

Evans, Ciaran**
DNA Mixture Analysis and the Number of Contributors

Fowlkes, Charless
Learning features for matching class characteristics in footwear impression evidence

Fuglsby, Cami**
U-Processes for Characterizing Forensic Sufficiency Studies

Gaborini, Lorenzo**
Multivariate likelihood ratio and Bayesian networks in questioned handwritten documents

Kooakachai, Monchai**
Statistical foundations of familial identification

Luby, Amanda
Frameworks for complex evidential reasoning: Statistical implications and comparative assessment

Salonen, Tuomas
Bayesian Comparison of Chemical Profiles of Amphetamine Samples

Spitzner, Dan
Dependencies in inference from forensic pattern data

Tyner, Samantha
Mock Juror's Understanding of Random Match Probabilities

Vilsen, Søren**
Predicting stutter ratios using the BLMM

Wilson, Amy
Software for the Analysis and Implementation of Likelihood Ratios (SAILR)

Zadora, Grzegorz
FTIR versus NIR - chemometric solution to the problem of spectral data evaluation with likelihood ratio (LR) approach

Zadora, Grzegorz
Fully-Bayesian likelihood ratio model – model of choice in case of sparse databases

Zhu, Xiaochen
Reproducibility of Statistical Forensic Methods: Logistic Regression and Kernel Smoothing

**Competing for the Young Investigator Award

WORKSHOPS

Glenn Langenburg, Cedric Neumann
Elements of forensic science for statisticians

This half day workshop is intended to introduce modern forensic analytical techniques and procedures to statisticians. During lectures and practical exercises, the audience will gain practical exposure to the recovery and analysis of different types of forensic evidence, as well as to the decision-making process that forensic analysists use to reach decisions on the source of traces. The workshop will also explore issues such as hierarchy of examination of multiple evidence types, and the combination of the results of conclusions from multiple evidence types. This workshop is primarily intended for statisticians, scientists and lawyers who recently became involved in forensic science and in evidence interpretation; however, more seasoned individuals will take advantage of the opportunity to see the deployment of forensic processes in a modern forensic laboratory. The workshop will benefit from lectures taught by practicing forensic scientists and will take place at the Minnesota Bureau of Criminal Apprehension (BCA), in St-Paul, MN. Transportation will be provided.

Glenn Langenburg, Cedric Neumann
Forum on communicating qualitative and quantitative evidence in forensic science

This half-day forum will be dedicated to the presentation of qualitative and quantitative information (e.g., conclusions of forensic examinations, error rates) to stakeholders of the justice system (e.g., jurors, judges, lawyers, police, journalists, …). To initiate and guide the discussion in this forum, two panels will present and discuss different methods of presenting evidence. The first panel will include experts in communication, psychology, law and forensic science. These experts will share the results of research and experience, and discuss best practices for communicating information to lay individuals. The second panel will include lay individuals, judges, lawyers, and police investigators; panel members will offer their understanding of statistics and inferential forensic statements and offer insight on the data offered by the first panel. The audience will be able to interact with the two panels and react to their position. The members of the second panel will be surveyed in real-time to understand first-hand their position on various points raised by the first panel or by the audience. The intention of this forum is to expose the difficulty of presenting scientifically appropriate conclusions to lay individuals in a fair and balanced manner, while enabling a rational decision-making process in the recipient of that information, and to discuss a way forward. The workshop will take place at the Minnesota Bureau of Criminal Apprehension (BCA), in St-Paul, MN. Transportation will be provided.

KEYNOTE

Hutton, Jane
University of Warwick, UK
Expert evidence: civil law, epidemiology and data quality

The contribution of statistics and epidemiology to many apparently medical questions is increasingly recognized. Often the first challenge when approached by a lawyer to provide an expert report in a civil case is to reach agreement on the right question to ask. Once instructions are clear, I often find myself considering whether the questions can be answered, given the quantity and quality of data and research.

Max, Brendan
Cook County Public Defender Office, IL
Reforming Forensics: What are the odds we do it and get it right?

Using case examples and discussion of forensic testimony from real cases, this talk will cover the current problems with methods and testimony of forensic examiners, the ways in which various constituents in the criminal justice community are resisting reform, and the roles scientists and lawyers can play in creating change and reform.

Mortera, Julia
Roma Tre University, Italy
Peter Green
Paternity testing and other inference about relationships from DNA mixtures

We present methods for inference about relationships between contributors to a DNA mixture and other individuals of known genotype. The evidence for such a relationship is evaluated as the likelihood ratio. We analyse real casework examples from a criminal case and a disputed paternity case; in both examples part of the evidence was from a DNA mixture. We find that taking full account of the uncertainty inherent in a DNA mixture can yield likelihood ratios very close to what one would obtain if we had a single source DNA profile. Our methods are not limited to the particular genotyping kits used, to the allele frequency databases used, to the numbers of contributors assumed, to the number of traces analysed simultaneously, nor to the specific hypotheses tested.

INVITED SPECIAL SESSION TO HONOR COLIN AITKEN'S WORK

Bozza, Silvia
Ca'Foscari University of Venice, Italy
Statistical issues in the assignment and reporting of Bayes factor for multivariate evidential data
Franco Taroni, Alex Biedermann

The use of the Bayes factor as a metric to assess the probative value of forensic traces is largely supported by operational standards in different forensic disciplines. The assignment of a Bayes factor may represent a demanding task with several sources of difficulty essentially due to the complexity of the case, to sensitivity issues related to the model choice and to prior assessments, and not last to computational impasses. Forensic laboratories have frequently access to equipment that can readily provide output in the form of multivariate data, showing a complex dependence structure with several levels of variation, a large number of variables and eventually a probability distribution that cannot be modelled by means of standard parametric families. Bayesian multilevel models may be proposed to deal with such constraints, and the implementation of numerical procedures may be required to handle the unavoidable complexity and to compute the marginal likelihoods in the numerator and in the denominator of the Bayes factor. A forensic expert will necessarily face the delicate task of finding the most appropriate way to deal with such sources of uncertainty while presenting expressions of evidential value at trial.

Nordgaard, Anders
Swedish National Laboratory of Forensic Science and Linköping University, Sweden
Classification of percentages in seizures of narcotic material

The percentage of the narcotic substance in a drug seizure may vary a lot depending on when and from whom the seizure was taken. Seizures from a typical consumer would in general show low percentages, while seizures from the early stages of a drug dealing chain would show higher percentages (these will be diluted). Legal fact finders must have an up-to-date picture of what is an expected level of the percentage and what levels are to be treated as unusually low or unusually high. This is important for the determination of the sentences to be given in a drug case.

In this work we treat the probability distribution of the percentage of a narcotic substance in a seizure from year to year as a time series of beta density functions, which are successively updated with the use of point mass posteriors for the shape parameters. The predictive distribution for a new year is a weighted sum of beta distributions for the previous years where the weights are found from forward validation. We show that this method of prediction is more accurate than one that uses a predictive distribution built on a likelihood based on all previous years.

Taroni, Franco
University of Lausanne, Switzerland
Alex Biedermann, Silvia Bozza
Relaxing the assumption of a direct person-source relationship in the evaluation of scientific findings given activity level propositions

The European Network of Forensic Science Institutes has published a guideline document on the evaluation and the reporting of scientific findings. It represents a step towards harmonizing evaluative reporting using the likelihood ratio as a common metric. The guideline also emphasizes the necessity to evaluate forensic findings given activity level propositions, especially when phenomena such as transfer and persistence are considered to have an impact on the understanding of forensic results relative to alleged activities. However, the nature of some types of transfer material (e.g. fibres) gives rise to additional complexities. For example, clothing found in possession of a person of interest (POI) may also have been worn by other persons. Reasoning about a POI's alleged activities thus requires one to make assumptions about the POI's connection with a given donor item. We will point out the relevance and intricacy of such considerations through formal analyses and Bayesian networks.

MEMORIAL INVITED SPECIAL SESSION: REMEMBERING STEPHEN E. FIENBERG

Carriquiry, Alicia
Iowa State University, IA
Remembering Stephen E. Fienberg

Steve Fienberg was a giant in the field of Statistics, and a strong proponent of the principled use of statistics in other areas, including forensic sciences. Steve's earliest work in forensic science dates back to the 1980s, and continued until his untimely death on December 14, 2016. He was a founding organizer of the ICFS, a member of the NAS, and a Principal Investigator in CSAFE. He was also a member of the now defunct National Commission on Forensic Sciences. Steve was generous with his time and his knowledge and greatly enjoyed mentoring young scientists. In his honor, all invited speakers in his memorial session are graduate students from the CSAFE institutions.

Galbraith, Christopher
University of California, Irvine, CA
Padhraic Smyth, Hal Stern
Statistical Analysis of User-Event Data in a Digital Forensics Context

Digital event histories of user activities are routinely logged on devices such as computers and mobile phones. These logs are typically composed of a list of events, each consisting of a user ID, timestamp, and associated metadata. As digital devices become more prevalent, these types of user-event histories are encountered with increasing regularity during forensic investigations. Although this type of digital data is of significant potential utility to investigators, there have been relatively few applications of statistical methods to its analysis in this context. In this talk we investigate the use of statistical techniques to assess whether two time-stamped event streams were generated by the same source or by different sources. We develop a general approach based on marked point processes and illustrate the utility of the approach on both simulated and real-world data. An emphasis is placed on evaluation and calibration of our method.

Liu, Alice
University of Virginia, VA
Henry Swofford, Fabian Zemp, Madeline Ausdemore, Anthony Koertner, Karen Kafadar
An overview of FRStat

To address the issue of subjectivity within the field of friction ridge analysis, the Defense Forensic Science Center has developed a software program, known as FRStat, that measures the similarity of a set of minutiae on a pair of fingerprints. FRStat utilizes statistical methods to summarize the similarity between the minutiae configurations into a statistic. Using this statistic, FRStat estimates the probability of observing a at least some value when impressions are made by the same source rather than by different sources; thus, providing a quantitative basis to the evaluation of friction ridge evidence. The FRStat software is the first method implemented into case-work operation within the United States to facilitate statistical interpretations of friction ridge evidence. This presentation will provide an overview of the FRStat software and associated performance metrics, as well as an explanation of the methods used to generate the probability estimates from empirical datasets

Park, Soyoung
Iowa State University, IA
Alicia Carriquiry, Hari Iyer
Toward a score-based approach to compare shoe sole impressions

We develop a score to compare a full or partial shoe outsole impression (Q) from an unknown source to an impression (K) from a known reference shoe. The data consist of the coordinates of all edges detected on each of the images. Degree of correspondence between Q and K will be quantified for several local regions of Q. We rely on graph theory and a maximum clique (MC) approach to quantify the degree of correspondence. An advantage of the MC method is its invariance to rotation and translation. Information from multiple local regions will be combined to construct a score using a suitable machine learning algorithm on ground truth known reference data collection. Initial results on a small sample of footwear impressions are promising. The next step is to explore the behavior of the score when it is computed for images that are known to have the same source and for images known to arise from different sources.

Spencer, Neil
Carnegie Mellon University, PA
Jared Murray
Modelling the Distribution of Randomly Acquired Characteristics in Footwear Evidence

If a suspect's shoe matches a crime scene print on brand, make, and size, forensic footwear examiners rely on randomly acquired characteristics (cuts and scrapes on the shoe's sole) to assess whether the suspect's shoe was the source of the print. The level of certainty of the match can be communicated as a likelihood ratio. However, likelihood ratios are only as reliable as the models used to determine them. The 2016 PCAST report criticized the theoretical nature of existing models in the literature, calling for the assumptions on which they are based to be empirically evaluated. Acting on these recommendations, we propose a new hierarchical Bayesian model for the distribution of accidentals on shoe soles. We fit and evaluate our model using shoe print data collected by the Israeli Police.

Tai, Xiao Hui
Carnegie Mellon University, PA
William Eddy
Determining Unique Sellers on Online Anonymous Marketplaces

Online anonymous marketplaces are commercial marketplaces that run on the dark web (parts of the web accessible only through anonymizing software such as Tor). Buyers and sellers preserve anonymity by using cryptocurrencies and PGP. As a result these marketplaces are used primarily for illegal activities such as sales of drugs. There are many such marketplaces, and in 2015, researchers obtained information on more than 20,000 seller accounts (Soska and Christin 2015). Sellers can operate accounts on different marketplaces, or multiple accounts on the same marketplace. In this work, we explore methods to match these accounts, to determine which of them in fact correspond to the same real-world entities. This would give a more precise measurement of the number of players active in these marketplaces over time. Information that we use includes sellers' profile description, types of products sold, countries shipped from/to, item listings, as well as customer feedback.

U.S. DOJ SPECIAL SESSION ON PRESENTING EVIDENCE

Antell, Kira M.
U.S. Department of Justice, D.C.
Forensic Examiner Language

The Department of Justice has taken unprecedented steps to strengthen forensic science, including investments in forensic science research, policies to establish quality assurance measures in laboratories, and guidance on forensic reporting and testimony. A primary focus has been improving the reliability of forensic analysis to enable examiners to report results with increasing specificity and certainty. Nevertheless, it is not always clear which language to use to meet the sometimes competing needs of the examiner, the client, the judge, and the jury. This will be an interactive session seeking discussion and input as to how to address these challenges under real world circumstances.

LECTURES

Aitken, Colin
University of Edinburgh, Scotland
Amy Wilson
Statistical significance - meaningful or not?

Variation by location in England of quantities of cocaine on banknotes in general circulation are described in Aitken et al (FSI, 2017). The dataset analysed is large with a large number of degrees of freedom. Any statistical test conducted has correspondingly high power. Very small differences in mean quantities amongst locations can be statistically significant but would not be judged meaningful by scientists. This example raises a general question. Statisticians tell courts that for an effect to be meaningful it is necessary for the effect to be statistically significant. However, statistical significance is not a sufficient condition for an effect to be meaningful. This can lead to a difficulty where testimony of no meaningful effect is interpreted by counsel as one of no statistically significant effect. Should the difference between a meaningful effect and a statistically significant effect be explained in reports and if so, how? Some possible answers will be proposed.

Armstrong, Douglas
South Dakota State University, SD
Cedric Neumann, Chris Saunders, John Miller
The development of a kernel-based method for model selection with example of an application to a forensic problem

The inference of the source of forensic evidence is related to model selection. Many forms of evidence can only be represented by complex, high-dimensional random vectors and cannot be assigned a probability distribution. A common approach to circumvent this is to measure the similarity between pairs of objects composing the evidence. Such methods are ad-hoc and unstable approaches to the judicial inference process. While these methods address the dimensionality issue they also engender intractable dependencies between scores when 2 scores have 1 object in common. Our approach involves a linear random effects model for the joint distribution of pairwise scores from a hierarchical sample and capture their inherent dependency structure. Its parameters

can be estimated directly without requiring any numerical optimization. Our model can be used to address high-dimension model selection problems in different situations and we show how to use it to assign Bayes factors to forensic evidence.

Ausdemore, Madeline
South Dakota State University, SD
Cedric Neumann, Christopher Saunders
Applications of Latent Dirichlet Allocation (LDA) Techniques to Mixtures of Dust Particles

Dust particles recovered from shoes may indicate the locations recently visited by an individual, and, in particular, the presence of an individual at a location of interest. A dust profile at a location is defined by a multinomial distribution over a fixed number of particle types. The probability distribution of the dust mixture corresponds to a mixture of these multinomials, and the parameters of the distributions can be studied via an LDA model. Contrary to standard topic models, the forensic problem involves constraints to account for the 'known' dust profiles of locations that the individual admitted or is suspected to have visited. We use Variational Bayesian Inference to study the posterior distributions of the location contributions to a mixture of dust recovered from shoes. We discuss the sensitivity of missing information on these posterior distributions, e.g., the exact number of locations present in the mixture, the exact nature of the dust profiles at each known location.

Berger, Charles
Leiden University and Netherlands Forensic Institute, Netherlands
Bas Kokshoorn, Bart Blankers, Jacob de Zoete
Even more on the hierarchy of propositions: Activity level propositions addressing the actor or the activity

Often, the source of DNA traces found at a crime scene is not disputed, but the activity or timing of events that resulted in their transfer is. Consequently, practitioners are increasingly asked to assign a value to DNA evidence given propositions about activities provided by prosecution and defense counsel. Given that the dispute concerns the nature of the activity that took place or the identity of the actor that carried out the activity, several factors will determine how to formulate the propositions. Determining factors are whether defense claims: (1) the crime never took place, (2) someone other than the accused performed the criminal activity, (3) the suspect performed an alternative, legitimate activity. Addressing such propositions using Bayesian networks, we demonstrate the effects of the various proposition sets on the evaluation of the evidence.

Biedermann, Alex
University of Lausanne, Switzerland
Silvia Bozza, Franco Taroni, Paolo Garbolino
A formal approach to qualifying and quantifying the 'goodness' of forensic identification decisions

In this paper we review and analyse common understandings of the degree to which forensic inference of source can be approached with statistics and is referred to, increasingly often, as a decision. We also consider this topic from the strongly empirical perspective of PCAST in its recent review of forensic science practice. We will point out why and how these views of forensic identification as a decision, and empirical approaches to it, provide only descriptive measures of expert performance and of scientific validity regarding particular forensic branches. These empirical accounts do not address the separate question of what ought to be a sensible,

i.e. 'good' decision to make in a particular case. The latter question, as we will argue, requires additional considerations, such as decision-making goals. We will use decision theory to make this understanding formally precise and illustrate the logic of qualifying and quantifying the relative merit of competing forensic decisions.

Buzzini, Patrick
Sam Houston State University, TX
Doug Armstrong, Cedric Neumann
A kernel-based method for the classification and quantification of the weight of evidence of textile fibers analyzed by microspectrophotometry (MSP)

MSP is an objective method for characterizing the color of textile fibers. Currently, spectra are compared visually using a heuristic process. Objective inference of sources of sets of unknown fibers requires considering that 1) sources of fibers are represented using multiple spectra; 2) spectra are high-dimension time series random vectors; 3) scientists may want to combine the results of different analytical techniques into a single inference process.
In this project, we use a random linear effects model to represent the distribution of the similarity scores between spectra. Our model can handle sets of multiple spectra in the same statistical analysis, does not require modeling time series and accommodate many different types of spectra due to the flexibility of our kernel-based approach. Our model correctly classified spectra from test fibers against a closed set of putative sources and quantified the weight of evidence for these fibers with minimal rates of misleading evidence.

Caliebe, Amke
Kiel University, Germany
Klaas Slooten
Likelihood ratios for an unknown number of contributors

In the analysis of mixed DNA samples the number of contributors is typically unknown. Recently, it has been debated whether the number of contributors chosen for the likelihood calculation should be the same for prosecution and defense hypotheses Hp and Hd. Here, we will investigate the general situation of likelihood ratio (LR) calculation when multiple scenarios (defined by a parameter theta) for the hypotheses are possible. Our prime example for these scenarios is a different number of contributors. In contrast to the case of a fixed number of contributors, the priors for theta and their relation to the priors of Hp and Hd are crucially important for the LR. We give the formula for the LR in the general case and for the case when the priors for theta and the hypotheses are independent. We will give several examples and apply the results of our analyses to point out difficulties and pitfalls in the calculation and reporting of the LR for an unknown number of contributors.

Chang, Ya-ting (Sabrina)
University of Edinburgh, Scotland
Colin Aitken, Grzegorz Zadora
Evidence evaluation and functional data analysis

A mathematical formulation is developed for a likelihood ratio where the data are functions. The propositions considered are those of common source and of different source for control and recovered data. Hierarchical models that take account of between- and within-source variation are developed. The function is modelled with B-splines. Various models for the variance of the functions are considered, including constant variance over the

support of the function, autocorrelation between neighbouring variances, functional variance (also modelled by B-splines) and functional principal component scores. Functional data are available on microspectrophotometry measurements in the visual range made for pen inks on which the methods are tested.

Cole, Simon
University of California, Irvine, CA
Matt Barno
How Do Forensic Practitioners Report Pattern Recognition Results in the United States?

Concerns about the education of forensic practitioners in the communication of forensic results tend to be future oriented: How do we educate forensic practitioners to communicate results in a scientifically defensible manner? This is often conceived as an obstacle to the adoption of statistical methods of reporting results. Surprisingly, relatively less attention is paid to the past and present. How do practitioners report results in the U.S. now? This study addresses this question for a number of forensic pattern recognition disciplines. Based on actual trial transcripts, affidavits, laboratory reports, etc., the study categorizes testimony based on the probative value attached to each report and the language used. Particular emphasis is placed on whether reports are "statistical" in nature. This study can give us a baseline understanding of how forensic results are reported now, against which efforts to encourage more statistical reporting can be measured.

Cuellar, Maria
Carnegie Mellon University, PA
Causes of Effects and Effects of Causes: A Study of Shaken Baby Syndrome

Over 1000 individuals in the United States are in prison today on charges related to the diagnosis of Shaken Baby Syndrome (SBS), a form of child abuse that results in traumatic brain injury. A heated debate among researchers is ongoing: One group argues that it is almost always possible to determine whether abuse caused a child's head trauma, and another group disagrees. To shed light on this debate, I propose the usage of the Causes of Effects (CoE) framework to evaluate causal statements made in medicine and the law. Using CoE allows one to evaluate how likely it is that a child's injuries are attributable to abuse. However, the data on SBS violates many of the assumptions necessary for an CoE analysis. Therefore, I suggest that the causal arguments made about SBS are too weak to prove abuse beyond a reasonable doubt. Thus, possibly many of the arguments used to convict individuals were incorrect, and this has caused numerous wrongful convictions.

Curran, James
University of Auckland, New Zealand
Jo-Anne Bright, Rebecca Richards, Maarten Kruijver, Hannah Kelly, Catherine McGovern, Duncan Taylor, John Buckleton.
Is probabilistic genotyping ready for prime-time?

The recent President's Council of Advisors on Science and Technology report Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature –Comparison Methods made a number of wide ranging statements regarding the reliability and utility of various forensic disciplines. Although the report was generally complimentary about the field of DNA interpretation, it suggested strict limitations to the current proof of validity for probabilistic genotyping methodology. In particular, claims were made regarding the scope of validation work that had been carried out and published in the peer reviewed literature, the utility of internal

validation performed by the developers of software for probabilistic genotyping software, and the ability of the methodology to deal with low level mixtures. These criticisms are most concisely summarised in the following paragraph:

"Most importantly, current studies have adequately explored only a limited range of mixture types (with respect to number of contributors, ratio of minor contributors, and total amount of DNA). The two most widely used methods (STRMix and TrueAllele) appear to be reliable within a certain range, based on the available evidence and the inherent difficulty of the problem. Specifically, these methods appear to be reliable for three-person mixtures in which the minor contributor constitutes at least 20 percent of the intact DNA in the mixture and in which the DNA amount exceeds the minimum level required for the method."

In this talk I will discuss the results of experiments designed to explore these issues the matter of error rate. I will also discuss some of the issues regarding the availability of source code and open source software.

Dawid, Philip
University of Cambridge, UK
Monica Musio, Rossella Murtas
Improved Bounds for the Probability of Causation

In many applications, such as disputes at Law, interest lies in whether a specific exposure can be regarded as having caused an observed effect. But given even the best possible empirical evidence about the probabilistic dependence of the outcome on the exposure, we can typically only provide interval bounds for the "probability of causation" for the case of a specific individual who has developed the outcome after being exposed. In this work, we show how these bounds can be refined if we have further information about internal mechanisms and processes, in the form of additional variables measured in the data. In particular, we show how this can be done using information on covariates, confounders and complete or partial mediators, separately or in combination.

de Koeijer, Jan
Netherlands Forensic Institute, Netherlands
Combining Forensic Evidence in Complex Cases

Bridging the gap between source level and activity level interpretation brings a wealth of possibilities for a more formal interdisciplinary approach to the evaluation of forensic evidence.
Prosecution and defense scenarios are analyzed for forensically verifiable elements for which activity level propositions are formulated. Evidence schemes are introduced in which two main types of evidence relations are identified: serial and parallel evidence. The evidential value of a 'serial evidence chain' is shown to be dependent on the weakest link in the chain and the prior distribution of the defense sub-propositions. 'Parallel evidence chains' from one or more forensic discipline evaluated in light of the same propositions may be combined, taking into account possible conditional dependencies.
The Bayesian framework in combination with the evidence schemes allows the expert to combine interdisciplinary evidence in a probabilistic but still intuitive manner.

de Zoete, Jacob
Queen Mary University of London, UK
Norman Fenton
Automatic Generation of Bayesian networks in Forensic Science

Constructing an effective and complete Bayesian network (BN) for individual cases that involve multiple related pieces of evidence and hypotheses requires a major investment of effort. Hence, generic BNs have been developed for common situations that only require adapting the underlying probabilities. This makes it practically possible to build and use BNs in casework. However, in some situations both the probability tables and the structure of the network depend on case specific details. For example, in crime linkage case the structure depends on the number of linked cases and the number of different pieces of evidence in each. We show it is possible to use R to generate both the structure and the underlying conditional probability tables. Furthermore, the entire workflow can be performed from an online GUI without specialist software. Such a workflow can reduce the workload for forensic statisticians and increase the mutual understanding between researchers and legal professionals.

de Zoete, Jacob
Queen Mary University of London, UK
Norman Fenton, David Lagnado
Modeling complex legal cases as a Bayesian network (BN) using idioms and sensitivity analysis with the Collins case as a complete example

The 1968 People v. Collins trial is famous for misuse of probability. Separate pieces of evidence were assumed independent, hence overestimating their combined evidential value. Researchers have explored the use of BNs to perform joint evaluation of evidence in cases such as Collins. However, two systemic problems limit the use of BN modelling of an entire case. The first is lack of a repeatable method for modelling certain types of evidence consistently; the second is the many conditional probabilities that inevitably need to be subjectively estimated, raising questions of validity of the resulting posterior probabilities. We address both problems using the Collins case as an example. The first is addressed by building on the idioms based approach, while the second is addressed using a thorough sensitivity analysis. By exploiting simulation in R, a sensitivity analysis is performed that shifts the attention from the posterior probabilities to the structure of the model.

Dettman, Josh
Massachusetts Institute of Technology Lincoln Laboratory, MA
Christopher Saunders, JoAnn Buscaglia
Forensic Discrimination of Copper Wire Using Trace Element Concentrations

The goal of this research is to develop analytical methods for measurement and statistical comparison of the chemical compositions of evidence. High-purity copper items may be recovered as evidence in cases such as thefts and improvised explosive device (IED) incidents; comparison of copper samples from a crime scene and a suspect can provide probative associative evidence and investigative leads. The discriminating power of a trace element-based method was estimated by analyzing copper refinery samples that represent within-source and between-source variability using Gaussian mixture modeling with a Bayesian Information Criteria metric and multivariate parametric- and empirical-based data simulation models with bootstrapping. This method shows potential: >90% of the copper samples can be correctly discriminated using a parametric-based model and >87% with an empirical-based approach (false exclusion rate = 5%). Ongoing work with other types of evidence will also be discussed.

Gastwirth, Joseph
George Washington University, DC
Some Recurring Statistical Issues in Analyzing Data in Equal Employment Cases

Although the U.S. Supreme Court accepted the results of statistical hypothesis tests for the analysis of data in cases concerning discrimination against minorities in jury pools and equal employment in 1977, several problems occur frequently. This talk will address several of them: when is it appropriate to combine the results of the analyses of related data sets? when is a data set too small for statistical results to be meaningful? How should one define "practical significance" and when should it be used in place of statistical significance? In age discrimination cases, should courts restrict themselves to comparing the status of applicants or employees at least 40 years old to that of those under 40 or when all the plaintiffs are over 50, say, should the "protected group" be employees over 50? These last two questions have generated splits among the circuits and data from some of these cases will be discussed and reanalyzed.

Gittelson, Simone
University of Technology Sydney, Australia
What the two-trace problem teaches us about DNA mixture interpretation

In the 1990s, Whittaker and Buckleton recognized that the two-trace problem, introduced by Evett (1987), appears in resolved DNA mixtures. This creates different evaluations of the weight of evidence of DNA mixtures for the commonly used pairs of propositions at sub-source and sub-sub-source levels (Taylor et al., 2014). This presentation introduces the complete model of the probabilistic relationships between the observations and the different pairs of propositions in a DNA mixture scenario, as a Bayesian network and as algebraic formulae. Sensitivity analyses illustrate how the weight of evidence varies in function of the pair of propositions, the probability that the person of interest is the major contributor given that the person of interest is a contributor to the mixture, and the prior probability that the person of interest is a contributor to the mixture.

Gupta, Anjali
University of Auckland, New Zealand
James Curran, Sally Coulson, Christopher Triggs
Dimensionality Reduction of LIBS Data for Bayesian analysis

In 2004, Aitken and Lucy described two-level likelihood ratio for multivariate trace evidence. This model has been adopted in a number of forensic disciplines such as the interpretation of glass, drugs (MDMA), and ink. Laser Induced Breakdown Spectroscopy (LIBS) instrument is capable of measuring many elements in low quantities and forensic scientists wish to exploit the potential of this extra information to increase the weight of this evidence. From a statistical point of view, the increase in the number of variables (dimension) in the problem leads to increased data demand to understand both the variability within a source, and in between sources. Usually we don't have sufficient information for this. One solution to this problem is to attempt to reduce the dimensionality through methods such as principal component analysis. In this talk, I will describe a study where we attempt to quantify the effects of this approach on the resulting likelihood ratios using LIBS data.

Hendricks, Jessie H.
South Dakota State University, SD
Cedric Neumann, Christopher Saunders, Danica Ommen
Approximate Bayesian Computation in Forensic Science

Although the Bayes Factor (BF) has been advocated to quantify the weight of forensic evidence, it cannot be directly evaluated for most evidence forms due to the difficulty to assign probability distributions to complex and high-dimension random vectors. Approximate Bayesian Computation (ABC) is an algorithmic model selection method that assigns the approximate posterior density of a set of parameters without direct evaluation of the likelihood function. When ABC was used to quantify the weight of glass evidence in a controlled environment, disparities between the ABC-BFs and analytical BFs were linked to the need to select a threshold value in the ABC algorithm. We propose a novel approach to assign the ABC-BF based on the first derivative of a parametric model, fitted to the empirical Receiver Operating Characteristic curve constructed from the ABC reference table. We used our methods to revisit a fingerprint model previously published in the Journal of the Royal Statistical Society.

Hofmann, Heike
Iowa State University, IA
Eric Hare, Alicia Carriquiry
Matching Bullet lands under degradation

Despite being an accepted and established forensic science practice, the process of matching bullets to determine whether they come from the same source has come under fairly intense scrutiny in recent years. In this talk, we outline an automatic method for assessing the probability of two bullets being fired from the same gun barrel. We use a simulation study to assess the performance of this algorithm under the scenario, that only fragments of the bullet land may have been recovered.

Inman, Keith
California State University, East Bay, CA
Clare Marsden, Norah Rudin, Kirk Lohmueller
Comparison of open source software for assessing the weight of evidence

It has been a challenge to compare different software approaches for assessing the weight of complex DNA profiles. The various approaches use different models which make different assumptions and are implemented in different ways. Furthermore, for some time, software that automatically modeled variables such as peak height and stutter was only available as proprietary programs.
Recently, the number of open source software programs has expanded to include options for more sophisticated modeling of multiple parameters, making it possible to perform a reasonable comparison between different models. In this work we compare the programs: Lab Retriever, LRmix Studio, (discrete) EuroForMix and likeLTD v.6.1 (iterative) on the same set of laboratory generated mixtures.
Specifically, we generated a set of 164 complex mixture samples each amplified 5 times, for a total of 820 samples. We compute LRs using the different programs to determine how profile complexity affects their performance.

Jeppson, Haley
Iowa State University, IA
Heike Hofmann
Online x3p Viewer

x3p is a file format developed by OpenFMC (the Open Metrology Forensics Consortium) to describe 3d surface images. While an open file format makes exchanging files between collaborators easy, viewing the images is harder: existing software is platform dependent and might not be freely available.
Recent developments in web tools have made it possible to provide an x3p viewer in form of an online app. We will demonstrate the use of the app with data from the NIST ballistics database.

Kaplan, Lotem
Carnegie Mellon University, PA
William F. Eddy
Bloodstain: A New Framework for Analysis

In this talk we address the problem of crime scene reconstruction based on bloodstain patterns. We use videos of experiments of bloodstain patterns designed by subject-matter-experts as an alternative to the use of theoretical equations and assumptions from the field of fluid dynamics. Using image processing tools to extract features from these videos, we give a representation to the shape and location of the drops of the splatter. This representation allows a full reconstruction of the original video and various properties of the trajectory and the fluid behavior. By processing videos of experiments, we collect essential data that provides fertile ground for studies of different properties of the trajectories and the dynamics of bloodstain patterns. The data is used to develop statistical models for description and inference from the videos. In addition, this approach allows us to assess the operating characteristics of common models and theories from fluid dynamics.

Kelly, Hannah
Institute of Environmental Science and Research, New Zealand
Jo-Anne Bright
Are large reference datasets useful for the validation of probabilistic genotyping software?

A recommendation of the recent President's Council of Advisors on Science and Technology [1] (PCAST) report on the interpretation of complex DNA mixtures was the creation and dissemination of reference profile datasets.
Such datasets contain collections of DNA profiles created from known mixtures that could be used to evaluate the foundational validity of probabilistic genotyping software and compare their performance.
This research investigates the utilisation of the PROVEDIt Initiative (Project Research Openness for Validation with Experimental Data) dataset from Boston University [2]. The use and limitations of common datasets in the validation of the probabilistic genotyping software STRmix(TM) is discussed.
[1] Executive Office of the President's Council of Advisors on Science and Technology. Report to the president Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods. 2016.
[2] http://sites.bu.edu/grgicak/provedit/

Koehler, Jonathan J.
Northwestern Pritzker School of Law, IL
The Case for Type II Proficiency Testing in Forensic Science

Most forensic science conclusions depend, in part, on the subjective judgment of the examiner. The accuracy of those conclusions cannot be estimated through reference to the examiner's training, knowledge or experience. Instead, accuracy should be estimated through rigorous and realistic proficiency tests that are designed to provide information about the rates at which examiners err in various relevant circumstances. Elsewhere, I have identified such tests as Type II Proficiency Tests (Koehler, forthcoming). In this presentation, I will argue that the results of Type II Proficiency Tests will provide courts with crucial information about the probative value of forensic science evidence in legal cases. I will suggest that estimated error rates are the most important of the reliability indicators identified by the U.S. Supreme Court in its 1993 Daubert decision. Without relevant error rate data, triers of fact have little basis for assigning weight to admitted forensic evidence.

Kruijver, Maarten
The Institute of Environmental Science and Research, New Zealand; and Vrije University Amsterdam, Netherlands
A novel approach to empirical validation of LRs in DNA mixture interpretation

Reports by PCAST and SWGDAM suggest validating software for DNA mixture analysis by conducting studies that investigate the probability of obtaining large LRs for true donors and small LRs for non-donors. We argue that such studies are not sufficient to show that the LR correctly represents the strength of the evidence. We present counter-examples of flawed systems that otherwise look fine in such a study. We propose instead to assess the validity of LRs by directly evaluating the accuracy of the probabilistic mixture deconvolution that underpins the LR calculations using ground truth known samples. From a statistical viewpoint, LRs are reliable if and only if the mixture deconvolution is unbiased. We apply the novel methodology to a set of >200 mixtures with 3, 4 and 5 donors in various ratios and down to low template levels.

Lancaster, Mark
Northern Kentucky University, KY
Open-Source Methods for Forensic Document Examination

From Srihari's CEDAR-FOX to Sciometrics' FLASH-ID, there are several systems that extract features from handwritten documents and automatically perform various document-matching tasks. These systems have proprietary algorithms, which make it difficult for researchers to perform adjustments to the methodologies in feature extraction and the calculations that allow the system to match possible suspects to a document with unknown writership. The ongoing research goal of this project is to build an open-source system that can perform on par with these existing systems, with flexibility in the choice of feature extraction and scoring metrics for writer similarity based on documents with known writership. Currently, this work is building from the well-known VLFeat library and the Comprehensive R Archive Network, and it is being designed to interface with the latest methods in likelihood-based scoring approaches.

Luby, Amanda
Carnegie Mellon University, PA
Joseph Kadane
Proficiency Testing of Fingerprint Analysts: A Bayesian Approach

In recent years, the forensic community has pushed to increase the scientific basis of forensic evidence, which has included proficiency testing for fingerprint analysts. We use data collected by Collaborative Testing Services in which 431 fingerprint analysts were asked to identify sources of latent prints. The data were analyzed using a multi-parameter Rasch model, with prior distributions included on each of the parameters to account for the lack of variation in some examiners and items. Although this approach provides valuable information about the relative ability of the examiners and the relative difficulty of the questions, it cannot extrapolate onto general performance of examiners or difficulty in casework. We illustrate this limitation through a Bayesian sensitivity analysis. We show that a Bayesian Item Response Theory model provides a deeper understanding of analysts' ability and question difficulty than other forms of analysis.

Mazumder, Anjali
Carnegie Mellon University, PA
John Aston, David Pagioli, Ferderic Ferraty, Martin Hall
Flies, damned flies & statistics: Functional domain selection for post-mortem interval estimation in forensic entomology

It is not unusual in cases where a body is discovered that it is necessary to determine a time of death or more formally a post mortem interval (PMI). Forensic entomology can be used to estimate this PMI by examining evidence obtained from the body from insect larvae growth. Growth curves however are temperature dependent, and usually direct temperature measurements from the body location are unavailable for the time periods of interest. In this work, we investigate models for PMI estimation, including temperature prediction, based on functional data analysis. We will evaluate the possibilities of using different models, particularly based on ideas from function registration, to try to obtain inferences concerning PMI and indeed whether multiple species data can be incorporated into the model. This can allow even more accurate estimation of PMI

Mazumder, Anjali
University of Warwick, UK
Jim Smith
Using Chain Event Graphs for Assessing Asymmetric Evidence

Bayesian networks, a class of graphical models, have been useful in providing a graphical representation of a problem, calculating marginal and conditional probabilities of interest, and making inferences particularly addressing propositions about the source or an evidential-sample. To address propositions relating to activities, there is a need to account for different plausible explanations of a suspect/perpetrator's actions and events as it relates to the evidence. We propose use of chain event graphs (CEGs), exploiting event tree structures to depict unfolding events as postulated by each side (defence/prosecution). Different explanations/scenarios can introduce different sets of relevant information affecting dependence relationship between variables and symmetry of structure. Using case examples involving transfer and persistence, we show how CEG can assist in careful pairing and development of propositions, addressing uncertainty and asymmetric unfolding events to assist courts.

Michael, Semhar
South Dakota State University, SD
Use of finite mixture models in bullet identification problem

In forensic science, bullet identification is one problem in the general framework of tool-mark identification studies. One of the main goals in bullet matching is to provide evidence for or against the proposition that observed "match" between a pair of bullets (based on striation marks on lands) arose from the same firearm. Recently, the National Institute of Standards and Technology (NIST) made a database of 3-D topographic surface map of bullets available. These can then be converted into a 3D data matrix by taking slices from the lands. In this work, we investigate applicability of finite mixtures of regression time series as models for the observed striation marks. Specifically, we will use finite mixture models as an unsupervised learning technique that allows for the incorporation of heterogeneity typically observed in a set of striae associated with a given bullet land.

Morrison, Geoffrey Stewart
Aston University, UK
Statistical procedures intended to avoid overestimating the strength of forensic evidence
Norman Poh

When strength of forensic evidence is quantified using sample data and statistical models, a concern may be raised as to whether the output of a model overestimates the strength of evidence. This is particularly the case when the amount of sample data is small, and hence sampling variability is high. This concern is related to concern about precision. This presentation describes, explores, and tests three procedures which shrink the value of the likelihood ratio or Bayes factor toward the neutral value of one. The procedures are: (1) a Bayesian procedure with uninformative priors, (2) empirical lower and upper bounds (Vergeer et al., 2016, http://dx.doi.org/10.1016/j.scijus.2016.06.003), and (3) a novel form of regularized logistic regression. As a benchmark, they are compared with (4) linear discriminant analysis. The behavior of the four procedures is explored using simulated data, and tested on real data from score-based systems, including voice and face comparison systems.

Newman, Jennifer
Iowa State University, IA
Wenhao Chen, Li Lin, Stephanie Reinders, Yong Guan, Min Wu
StegoDB: A dataset for detecting mobile phone steganography

Steganography is the field of hiding a message in an image to communicate covertly. State-of-the-art steganography detection, or steganalysis, uses pattern classifiers trained on image data. An image is classified with the forensic feature of stego, if an image has a message embedded, or cover, if not. In this work, we present research to detect stego images that are created using a steg app on a phone. Currently, there appears to be very few, if any, forensic tools that successfully can detect such stego images. We use the database StegoDB, created for benchmarking steg detection. To our knowledge, no other researchers have designed a similar approach for steganalysis on images generated by mobile steg apps. We analyze and present our results in context of prior work done not only by the academic steganalysis community, but also for the interest of digital image forensic practitioners. We hope to initiate discussion on forensic tools that could fill this gap.

O'Brien, Austin
Dakota State University, SD
Christopher Saunders
A kernel based approach to determine atypicality

This talk will outline the development and use for a new probabilistic measure for unary classification, referred to as atypicality. This statistic is developed using a two-stage approach for evidence interpretation. The atypicality statistic can be used as a p-value in a hypothesis test to determine if some unknown source trace objects are typical of known source objects. This hypothesis test can be used in a variety of forensic applications, especially where we have trace objects in multi-dimensional space.

Ommen, Danica
South Dakota State University, SD
Cedric Neumann, Christopher Saunders
Recent Developments on a Distributional Quantification for the Likelihood Ratio

Currently, handling uncertainty in quantifying the value of evidence is among the most debated issues in forensic statistics. We view the likelihood ratio (LR) and the Bayes Factor (BF) as distinct: the statistic used in Bayes classification rules is the LR, while the statistic used in formal Bayesian model selection is the BF. One argument against presenting uncertainty intervals for the LR is that the center of the interval will often be biased. In this presentation, we will review the controversy concerning interval quantifications for the LR and BF. The construction of a posterior distribution for the LR with the BF as the mean will be derived, which suggests that it is not biased. Using this posterior distribution, approximate credible intervals for the LR exist which are guaranteed to cover the true LR. Various strategies for constructing these intervals will be discussed. Finally, we will demonstrate how to use these intervals for determining the number of samples to collect.

Pan, Qing
George Washington University, DC
Joseph Gastwirth, Weiwen Miao
Statistical procedures for assessing the need for an Affirmative Action plan: A reanalysis of the Shea v. Kerry case

In the 1980's Congress and GAO issued reports with statistical evidences showing that employees in the Foreign Service were predominantly white and male. The State Department instituted an affirmative action plan for 1990-1992 that allowed females and race-ethnic minorities to apply directly for mid-level positions. A modifies Hotelling's T-Test is employed test the null hypothesis of fair representation against a one-sided alternative of under-representation, which yields p-values less than 1 in 10,000 indicating that females and African-Americas were substantially under-represented in the major job categories. Excluding secretarial and clerical jobs led to even larger disparities. These results confirm the court's decision that the imbalance between the female and African-American proportions of employees in the State Department and their proportions of the national labor force was substantial. The Department was justified in implementing its affirmative action plan.

Pan, Karen
University of Virginia, VA
Karen Kafadar
Statistical Modeling and Analysis of Trace Element Concentrations in Forensic Glass Evidence

ASTM has published three standards related to different test methods for forensic comparison of glass (micro X-ray fluorescence spectrometry (XRF), ICP-MS, LA-ICP-MS) that includes a series of recommended calculations from which "it may be concluded that the samples are not from the same source." Using publicly available data from Florida International University and from other sources, we develop statistical models based on estimates of means and correlation matrices of the measured trace element concentrations recommended in the ASTM standard, leading to population-based estimates of error rates for the comparison procedures stated in the standards. Our results therefore do not depend on internal comparisons between pairs of glass samples, the representativeness of which cannot be guaranteed: our results apply to any collection of glass samples that have been or can be measured via these technologies.

Perlin, Mark
Cybergenetics, PA
Forensic match information: exact calculation and applications

The log likelihood ratio (LLR) summarizes the weight of evidence for one person. An LLR can be compared with the LLRs of all people. Measure theory reduces the people set to a distribution.
The contributor distribution (CD) shows LLRs for people who contributed to the evidence. Average CD value expresses evidence inclusionary power. LLR position in the CD reflects contributor probability. A left CD tail gives false exclusion probability.
The noncontributor distribution (ND) describes LLR values for the population. Average ND value expresses evidence exclusionary power. A right ND tail is the false match probability of inclusionary error, useful to jurors.
The exact LLR distribution is rapidly constructed from independent evidence tests. Information theory permits fast CD or ND determination for one test. Convolution of logarithmic tests yields the joint LLR distribution. We describe rapid calculation of exact LLR distributions. A DNA case example illustrates forensic applications.

Petraco, Nicholas
John Jay College of Criminal Justice, NY
Algorithmic Toolmark Identification: Lessons Learned From A Decade of Data Collection, Feature Extraction and Statistical Analysis

Forensic firearm and toolmark examiners have encountered harsh criticism that there is no accepted methodology to generate numerical ""proof"" that independently corroborates their morphological conclusions. The focus of our research over the last decade has been to investigate the validity of toolmark pattern analysis from an objective, algorithmic and numerical perspective; that can ultimately withstand the scrutiny of the adversarial legal system. We have successfully exploited 3D microscopy and applied various machine-learning techniques as a step towards accomplishing this goal. In the process of accomplishing this goal we quickly realized ""doing the statistics"" is one small part of a multidisciplinary topic. In order to produce useful statistically based research products for the wider forensic community, groups must gain a level of expertise in the practice of forensic science, legal procedure, microscopy, computational infrastructure and digital imaging.

This kind of experience does not come quickly and fundamentally necessitates strong and trusting collaborative relationships. In this talk we will outline the technical issues encountered in building a successful statistical program for the algorithmic analysis of firearm and toolmark data. Special attention will be paid to how we overcame these issues with the help of many other groups around the world. Biasotti-Murdock (CMS-Space) feature extraction will be discussed along with stochastic toolmark simulation/generation. With this birds-eye view of what data needs to be ""feed into the machine"" we will then progress to a set of ideas to estimate the ""quality"" of a machine made association between a tool and a toolmark, in a falsifiable way. Our approach in this direction is agnostic; employing a mixture of frequentist and Bayesian ideas. As a "frequentist" based approach to association quality, we will describe how conformal prediction theory can be used to assign orthodox confidence levels to each toolmark identification. For a ""Bayesian"" oriented approach we will describe how Efron's 2-groups empirical Bayes methodology can be applied to the same problem, this time producing posterior probabilities and likelihood ratios

Sjerps, Marjan
Netherlands Forensic Institute, Netherlands
Kees van der Beek, Astrid Quak, Ate Kloosterman
Dealing with errors and adventitious matches in forensic DNA

DNA evidence is an important forensic field. However, sometimes one reports a match with the wrong person, or fails to report a true match. The main causes are human errors and adventitious database matches. We consider these two causes in depth: (1) What is an error/its impact? We present a scoring system distinguishing between different types of error and between different levels of actual and potential consequences (based on Kloosterman et al. 2014); (2) How often? We present recently updated figures on the various types of errors and their consequences, and figures on adventitious database matches; (3) Effect on evidential value? The figures presented are relevant for quality control and benchmarking, and promote an open research culture. But a case requires case-specific probabilities of undetected errors and of e.g. DNA-transfer. We show how Bayesian networks can combine all this; (4) How to communicate? We discuss communication of these findings to the court.

Stern, Hal
University of California, Irvine, CA
Eric Lai
Characterizing handwriting complexity for forensic evaluations

Forensic examination of handwriting relies on the principle that more complex writing or signatures enhance the ability of examiners to distinguish between genuine and simulated signatures. An ongoing study by the Los Angeles City Police Department and Los Angeles County Sheriff's Department is exploring the relationship of subjective assessments of complexity, dynamic analyses of signatures and studies of examiner performance at distinguishing genuine and simulated signatures. To enhance the utility of the study this presentation uses image-based analysis as an approach towards objectively assessing signature complexity. The new approach is compared to existing approaches based on counts of strokes and crossings.

Tang, Larry
George Mason University, VA
Elham Tabassi
Likelihood Ratios in Forensics: What They Are and What They Are Not

To clarify on the statistical interpretation of the forensic likelihood ratios, our presentation will contribute to the literature in the following ways:
1) It provides the frequentist interpretation of the Lindley (1977)'s likelihood ratio and give the formal definition of the rarity terms in the likelihood ratio. The evidence measurements required for these different likelihood ratios are also discussed in details. Using the glass fragment example in Lindley (1977) and Evett (1977), we illustrate the relationship between the likelihood ratios and population parameters.
2) Through the glass example, it shows explanation of Lindley's paradox (Lindley, 1957).
3) It provides in-depth discussion on the similarities and the differences between the likelihood ratio based on original features and the score-based likelihood ratio.
4) The LR in forensic science is sometimes confused with the LR for hypothesis testing. Our article shows the essential difference between these LRs.

Thompson, William
University of California, Irvine, CA
Rebecca Grady, Eric Lai, Hal Stern
Lay Perceptions of the Strength of Source Conclusions

We studied lay perceptions of the relative strength of various conclusions that a forensic scientist might present after comparing two items (fingerprints; biological samples) to determine whether they have a common source. Lay participants made a series of judgments about which of two conclusions seemed stronger for proving the items had a common source. The data were fitted to Thurstone-Mosteller paired comparison models to obtain a rank-ordered list of the various statements and an indication of the perceived differences among them. The results allow calibration of verbal statements regarding weight of evidence (e.g., "extremely strong support for same source") relative to source probability statements (e.g., "highly probable same source"), random match probabilities (e.g., RMP = 1 in 100,000), and likelihood ratios. These comparisons in turn provide insight into whether particular statements will be perceived in the manner intended or in ways that are unintended.

Veenman, Cor
Netherlands Forensic Institute and Leiden University, Netherlands
Peter Vergeer, Charles Berger
Likelihood Ratios from Quasi Posterior Odds

LRs are typically determined from the conditional probabilities of the evidence given the prosecutor's and defense hypotheses. Especially with high dimensional feature vectors, this is a most challenging task, since then lots of data are needed to train an LR system.
We propose to calculate LRs using a specifically designed classification model that differentiates observations made under both hypotheses. For the purposes of the calculation only, we assume equal priors. We call the resulting posteriors 'quasi posterior probabilities', since they do not reflect the posteriors of the underlying inference problem. They are only used to calculate an LR, which then equals the quasi posterior odds. Using this approach, many recent methods become available, which are able to deal with sparse data, such as

support vector machines, random forests, and (deep) neural networks. These methods often need probability calibration or likelihood ratio calibration before application in forensic cases.

Vergeer, Peter
Netherlands Forensic Institute, Netherlands
Andrew van Es, Arent de Jongh, Ivo Alberink, Reinoud Stoel
LRs from score based likelihood ratio systems are often based on extrapolation: when to stop extrapolating?

Many automated likelihood ratio systems are based on a comparison score for trace and reference material. Distributions of the score given a same source origin (H1) or a different origin (H2) are based on sample data. Intuitively, the value of a LR outputted by such a system should be limited by the sample size. For example, if the distribution of the score given H2 is based on 1000 comparisons, a LR should not be larger than 1000. Unfortunately, this intuitive rule has not been backed up by scientific arguments.
This contribution deals with this problem by using a scientific approach for determining extrapolation limits for the LR [1]. The result is a lower and an upper bound for the LR outputted by the system. This result is obtained using a binary decision perspective for measuring performance of LR systems known as the Normalized Bayes Error-Rate[2].
References
[1] Sci. Jus. 56 (2016) 482.
[2] N. Brummer, PhD thesis, Un. of Stellenbosch, 2010.

Vergeer, Peter
Netherlands Forensic Institute, Netherlands
Danica Ommen
Several approaches to the LR: which is better?

In the literature, several approaches to the LR addressing source level propositions exist. On the one hand one has LR systems addressing common source or specific source hypotheses (e.g. trace and reference share a common source or the source of the trace is this reference), on the other hand one may regard as evidence the features for trace and reference or a comparison score between trace and reference.
In this contribution several questions are addressed.
1. Is feature based better than score based?
2. Is specific source better than common source?
3. Are all these LR approaches helpful in court or do some make decisions worse?
Information theory is chosen as a means to answer these questions.

Vosk, Ted
Alaska Legal Services Corporation, AK
Metrology: The Epistemology of Forensic Measurements

Measurement does not reveal what a quantity's true value is. Rather it represents a structured process by which empirical information can be collected and processed to create knowledge in the form of beliefs concerning the quantitative values that can be assigned to a quantity and justified in a statistically rigorous manner. Metrology, the science of measurement and its application, provides a framework for building epistemologically robust

knowledge through scientific measurement and a shared basis for understanding what conclusions the results of forensic measurements can support in legal and forensic contexts. The inherent structural differences between legal and forensic contexts create inferential road blocks to the discovery of truth in the courtroom. Employing metrology as an applied epistemology allows many of these impediments to knowledge building/fact finding to be overcome and facilitates the creation of legal foundations that are sound in science as well as the law.

Wilson, Amy
University of Edinburgh, Scotland
Colin Aitken, Richard Sleeman, Byron Morgan, Jade Huish
Distribution of cocaine on banknotes in general circulation in England and Wales

Measurements of traces of cocaine on banknotes have been used in court as evidence to support association with drug crime. To assess the weight of this evidence, a database of banknotes from general circulation must be formed. Given that usage of cocaine varies by region, questions arise as to whether this database should be formed from banknotes specific to the region in which the crime was committed. This work performs a statistical study of variation in the quantity of cocaine contamination on banknotes in general circulation in England and Wales. Samples of banknotes returned for destruction to eight different redistribution centres across England were tested for cocaine. The results were analysed for differences in contamination by comparing mixed effects models with and without the location of the redistribution centre as a factor. Results suggested that there was no variation in cocaine contamination between different locations in England and Wales.

Zadora, Grzegorz
Institute of Forensic Research, Poland
Agnieszka Martyna, Hans-Eike Gäbler
The hybrid likelihood ratio models for verifying the origins of the wolframites

The likelihood ratio (LR) approach was applied for verifying the authenticity of the declared origins of wolframites, which illegal mining and trading is constantly controlled across the Africa on account of exacerbating the violent conflicts. The laser ablation inductively coupled plasma mass spectrometry provided 46 elements composition found as a fingerprint for addressing the issue of similarity between ca. 100 samples. Complex variability within samples, usually comparable to this between samples, precluded the direct application of the LR framework. Hence the hybrid LR models were proposed which incorporated the outcomes of partial least squares discriminant analysis or Kolmogorov-Smirnov distance with the LR models. Joining the merits of these approaches for reducing data dimensionality, extracting the most discriminative features and commenting on the potentially common origins of samples yielded passable results.

Zadora, Grzegorz
Institute of Forensic Research, Poland
Agnieszka Martyna, Aleksandra Michalska
The use of multiblock PCA within the hybrid likelihood ratio models for interpretation of highly multidimensional data

Interpretation of the data in the forensic scenarios usually involves concentrating on more than a single dataset. Thus, the researchers face the need for developing the tools for interpreting data collected either using two methods distinctively differing in physicochemical foundations or using a single method with various instrumental parameters. For extracting of the most informative features of both datasets the multiblock PCA was applied, which outcomes were incorporated in the likelihood ratio (LR) framework. The usefulness of this methodology was proved for the comparison problem of polymer materials collected from the vehicles body and plastic household containers described by both spectra recorded using Fourier transform infrared spectrometry and chromatograms recorded using pyrolysis gas chromatography mass spectrometry, and for blue car paints described by Raman spectra got using two different wavelengths lasers (785 and 514.5 nm).

POSTER

Baldaino, JenaMarie
Oak Ridge Institute for Science and Education, TN; and Federal Bureau of Investigation Laboratory, VA
Danica Ommen, Cami Fuglsby, Christopher Saunders, Jack Hietpas, JoAnn Buscaglia
Characterization of Aluminum Powders in Explosives Utilizing Particle Micromorphometry

Aluminum (Al) powders have a variety of legitimate uses and are commonly used in pyrotechnics and explosives as a fuel to increase the heat of explosion. Al powders can be purchased from industrial manufacturers or can be produced at-home using amateur methods. The primary goal of this project is to investigate the potential of particle micromorphometry to differentiate Al powder sources and to provide insight into the method of Al powder manufacturing. This presentation addresses fundamental factors of Al particle metrology including sample slide preparation, imaging parameters, and potential methods to minimize sampling biases. We will also discuss the issues with these large multidimensional datasets and the initial statistical methods under investigation.

Basulto-Elias, Guillermo
Iowa State University, IA
Martin Silerio-Vazquez
Shoe matching based on image cross-sectioning

We explore an approach to compare images of shoe outsoles that begins by cross-sectioning the image obtained from a question (Q). Each section is then compared with corresponding sections in a known (K) print. The approach is a reminiscent of methods used in the analyses of tool marks and firearms. For each section, we define multiple features and study their distribution for pairs of images that are known to match and pairs of images that are known to be non-matches. We built a small database of shoeprints using an Everspry EverOS(TM) Shoe Outsole Scanner. The images obtained are highly detailed, and may permit tuning the method to minimize the occurrence of false-positives.

De March, Ilaria
University of Lausanne, Switzerland
Emanuele Sironi
Combining evidence and decision analysis in a casework involving bloodstain traces

Forensic cases often involve a large number of items of evidence of different types, which forensic scientists and decision makers must consider in a global perspective. Graphical probabilistic models are important tools allowing one to represent probabilistic relationships between relevant variables describing a problem at hand. In

this work, a criminal case has been modelled by means of a Bayesian network. The evidence of interest consists in the results of a bloodstain pattern analysis conducted on a suspect's garments, which were worn during a fight ended in murder. The key inferential element for this case is played by a missing item of evidence, whose role in the model is discussed. Decision theory also plays a major role to justify a rational decision about the charge under which the suspect is to be prosecuted, as well as in deciding on the need to collect further physical traces.

De March, Ilaria
University of Lausanne, Switzerland
Emanuele Sironi
Bayesian networks for combining dental and skeletal evidence in age estimation of living persons

The age estimation of living persons is nowadays an important practice for many forensic and medico-legal services worldwide. A probabilistic graphical model for evaluating evidence gathered from multiple physical attributes (e.g. development state of the third molar, hand and wrist bones, medial clavicular epiphysis) has been developed and applied to a scenario where a person is examined by physicians in order to update the belief on the age variable expressed through propositions of juridical interest (e.g., younger or older than a legal threshold). The model allows one to coherently assess all uncertainties associated to the process of aging. The advantages offered by the probabilistic model to deal with multi-factorial evidence and its performance are illustrated.

Evans, Ciaran
Carnegie Mellon University, PA
Anjali Mazumder
DNA Mixture Analysis and the Number of Contributors

DNA is widely used in court systems and investigations. While it is known how to calculate probabilities for single-source, high quality samples, technology has increasingly allowed for analysis of poor-quality mixtures with limited DNA. These samples are more difficult to interpret and can be heavily influenced by artefacts. The number of contributors to a mixed sample must be either specified or integrated out in calculations. While prior studies have examined the results of mis-specifying the number of contributors, less work has been done on the interaction of these effects with artefacts, relatedness, and database searches. We evaluate the performance of methods for estimating the number of contributors on labeled forensic mixtures, focusing on how artefacts alter the estimated number of contributors. We further examine how different estimates of the number of contributors may produce different results in a database search, and how relatedness interacts with estimates.

Fowlkes, Charless
University of California Irvine, CA
Bailey Kong, James Supancic, Deva Ramanan
Learning features for matching class characteristics in footwear impression evidence

Automatic determination of class characteristics from crime scene footwear impression evidence is made difficult by the wide variability in the quality of evidence (impressions left on different surface types, distortions, partial prints, etc.) and limited availability of large databases of tread patterns. We have empirically evaluated a variety of image-based features and similarity metrics for matching partial crime-scene prints to test impressions. We find that normalized correlation of deep convolutional neural-network features provides

the strongest baseline for matching, outperforming many features proposed in the literature. We utilize machine learning techniques for metric learning to further improve cross-modal matching performance. These results provide a basis for developing score-based likelihood models and quantifying the reliability of class characteristic determination for footwear impression evidence.

Fuglsby, Cami
South Dakota State University, SD
JoAnn Buscaglia, Christopher Saunders
U-Processes for Characterizing Forensic Sufficiency Studies

One of the main metrics for deciding if a given forensic modality is useful across a broad spectrum of cases is the Random Match Probability (RMP), or the corresponding discriminating power. Traditionally, the RMP of a given modality is studied by comparing full 'templates' and estimating the rate at which pairs of templates 'match' in a given population. This strategy leads to a natural U-statistic of degree two. However, in questioned document examination, the RMP is studied as a function of the amount of handwriting contained in the two documents being compared; turning the U-statistic into a U-process. This work is focused on providing background on forensic sufficiency studies, RMP, and the U-processes that naturally arise in this class of problems. The kernels are inherently discrete, which leads to a number of issues for highly accurate methods, which we will explore and discuss.

Gaborini, Lorenzo
University of Lausanne, Switzerland
Franco Taroni, Silvia Bozza
Multivariate likelihood ratio and Bayesian networks in questioned handwritten documents

In this project we propose and investigate the usage of Bayesian hierarchical models for supporting experts in examinations of questioned documents.
Through the use of Bayesian networks, we envision to quantify the probative value of well-defined measurements performed on questioned handwritten material, in a way that is both formalised and coherent. At the current stage, we focus on several statistical issues encountered during their construction, ranging from data dimensionality reduction to the computation of likelihood ratios on multivariate data. With the resulting gain of knowledge, we will seek to approach related forensic disciplines, such as questioned signature examinations. The ultimate goal is to merge different contributions to a single probabilistic measure of strength of handwritten evidence using Bayesian networks.

Kooakachai, Monchai
University of Colorado, CO
Bonnie Mountain, Greggory LaBerge, Stephanie Santorico
Statistical foundations of familial identification

Since 2007 the Denver Police Crime Laboratory has been performing familial DNA searches using a likelihood ratio method, successfully providing over 20 investigative leads. However, the likelihood ratio can only be computed if the allele frequencies for the genotyped markers in the profile are known, which is dependent on an individual's ethnicity, but the ethnicity of any forensic sample obtained is unknown. This may be suboptimal as population substructure is not incorporated into the likelihood ratio calculation. The purpose of this study

is to investigate performance of the existing likelihood ratio approach as well as additional approaches that incorporate population substructure adjustments. We also propose an alternative probabilistic approach which directly addresses underlying population substructures. We determine thresholds for a set of reasonable false positive rates, and assess statistical power of the new test compared with existing approaches.

Luby, Amanda
Carnegie Mellon University, PA
Anjali Mazumder, Brian Junker
Frameworks for complex evidential reasoning: Statistical implications and comparative assessment

In recent years, forensic analysts have been asked to assess activity-level propositions, which go beyond identifying a suspect and begin to address the likelihood of observing certain evidence under different situations. This often involves combining multiple types of evidence, which increases the complexity of the joint probability distributions. To simplify these distributions, experts have often turned to Bayesian Networks. There has been work within the legal setting to communicate probabilistic relationships through formal argumentation frameworks. We explore some of these translations of Bayesian Networks, including Wigmore Charts, Arguments, and Scenarios. In particular, we identify differences in these methods between a legal perspective and a forensic science, or investigative, perspective. We also discuss the statistical ramifications of these methods, including whether or not information is lost in translation and eliciting expert judgment using alternative frameworks.

Salonen, Tuomas
University of Helsinki and Forensic Laboratory of the National Bureau of Investigation of Finland, Finland
Sami Huhtala, Tapani Reinikainen, Jukka Corander
Bayesian Comparison of Chemical Profiles of Amphetamine Samples

Whether two seized amphetamine samples share a source is often determined by comparing their chemical impurity profiles using a dissimilarity metric based on Pearson correlation coefficient. This method often suffers from poor discriminating power resulting in over- or underestimating similarity between samples, making interpretation of results difficult. Thus, in this work a Bayesian probabilistic method for measuring profile similarity is proposed. A hierarchical statistical model incorporating both prior knowledge of population level variance and measurement uncertainty is developed for the chemical profiles. Based on this model, the profile similarity is assessed by comparing the posterior predictive distributions induced by the profiles using the so-called predictive agreement previously applied to forensic oil comparison.The proposed method promises robust and reliable assessment of sample similarity and is general enough to be applied to other drugs as well.

Spitzner, Dan
University of Virginia, VA
Maria Tackett
Dependencies in inference from forensic pattern data

This talk describes a conceptual framework for valid statistical inference from pattern data, such as those measured from fingerprints or shoe-marks. Our interest is two-fold: First, we develop a set of guidelines for designing and improving databases in order that they are sufficiently informative for inference, both in the

development of error models and the elicitation of prior information. Second, we wish to understand the dependency of between evidence reports when there are multiple inputs contributing data to an investigation. For example, suppose a particular print and one or more supplemental prints are flagged (e.g., by an examiner or automated algorithm) as important in the sense of its resemblance to a mark left at a crime scene. We examine the question of whether evidence in the former print of its connection to the crime would be quantified and reported differently depending on whether the latter prints are taken into consideration.

Tyner, Samantha
Iowa State University, IA
Heike Hofmann
Mock Juror's Understanding of Random Match Probabilities

In 2016 Thompson & Newman examined Amazon Mechanical Turk workers' interpretations of 3 statistical representations of forensic evidence in their study, "Lay Understanding of Forensic Statistics". We expand on the most consistent method, random match probabilities (RMPs), and present our Turk workers with similar fictionalized details of a sexual assault court case in which the forensic evidence implicating the defendant was one of a shoeprint, a clothing fiber, a fingerprint, or a DNA sample left behind at the crime scene. We also vary the strength of evidence: moderate (RMP=1/100) or very strong (RMP=1/10e6). The participants were asked to give an estimate of probability of the defendant's guilt before & after the presentation of the forensic evidence, and changes in their estimates were examined. We hypothesize that mock jurors will increase their probability of guilt estimates the most for very strong DNA evidence, and the least for moderate shoeprint evidence.

Vilsen, Søren
Aalborg University, Denmark
Torben Tvedebrink, Poul Svante Eriksen, Helle Smidt Mogensen, Niels Morling
Predicting stutter ratios using the BLMM

Stutters are a well documented artefact of the amplification of short tandem repeat regions when using a polymerase chain reaction (PCR) occurring as strands one motif shorter or longer than the allele. As PCR remains a necessary part of analysing DNA samples, understanding the mechanism and rate by which stutters are created is important. It has been shown that there is a linear relationship between the longest uninterrupted stretch (LUS) and the stutter ratio. This holds if there is only a single stutter. However, sequencing, we see that alleles may create multiple stutters. Thus, we need to refine the LUS concept. The stutter hypothesis is simple: The more repetitive a DNA strand is, the more likely the PCR is to stutter. Therefore, we look at any uninterrupted stretch and identify from which stretch the stutter came. We define the BLMM, as the length of this stretch. We show that the prediction error decreases by a factor between 1.03-12.8, when switching from LUS to BLMM.

Wilson, Amy
University of Edinburgh, Scotland
Annabel Bolck, Colin Aitken, Leon Aronsson, David Lucy, Petter Mostad, Tereza Neocleous, Anders Noordgaard, Dennis Steenhuis, Grzegorz Zadora
Software for the Analysis and Implementation of Likelihood Ratios (SAILR)

The SAILR project is a European collaboration aiming to develop user friendly, validated and freely available software for evaluating likelihood ratios for forensic evidence. The software (SAILR) currently includes scripts for evaluating likelihood ratios for the comparison of sources problem and problems of discrimination. Likelihood ratios for both feature-based and score-based models can be estimated. Scripts in SAILR have been validated by comparing results for test datasets to results from scripts developed independently by project partners. SAILR also has the functionality to perform basic checks on the data and to validate model choices for a given dataset using rates of misleading evidence. As software already exists for DNA evidence, SAILR focuses on models for other forms of evidential data, such as measurements on glass fragments or of drug traces. This poster will introduce the models in SAILR and provide screen shots of its use for the estimation of likelihood ratios.

Zadora, Grzegorz
Institute of Forensic Research, Poland
Alicja Men yka, Agnieszka Martyna
FTIR versus NIR - chemometric solution to the problem of spectral data evaluation with likelihood ratio (LR) approach

Polymers, despite being widely regarded as an evidence unworthy of serious consideration, surprisingly often may provide valuable information during forensic investigations. Herein, the possibility provided by the LR approach to estimate the evidential value of similarities and differences between NIR and FTIR spectral data, originating from automotive parts and household items, was investigated.
As construction of LR models requires introducing only a few variables, the main effort, directed towards reducing the dimensionality of the spectra, involved compressing the signal using discrete wavelet transform followed by the SELECT algorithm for the selection of the most informative coefficients, which eventually served as an input for LR models.
Acceptable performance of models based on both NIR and FTIR data, assessed by measuring the rates of false answers and by applying ECE approach, demonstrated the utility of polymers, serving as mute witnesses of such events as car accidents.

Zadora, Grzegorz
Institute of Forensic Research, Poland
Patryk Własiuk, Daniel Ramos
Fully-Bayesian likelihood ratio model – model of choice in case of sparse databases

The classification problem might be of forensic interest with the aim of helping investigators in the search of appropriate control materials. Such problem is solved with Likelihood Ratio (LR) methodology that gives the support to one of two hypotheses put forward by the fact finders. The value of LR is calculated based on background database used for population parameter's inference. In this work a popular plug-in approach based on the point estimates of those parameters is contrasted with fully-Bayesian approach that includes the uncertainty in this inference. The LR model based on the latter approach is advocated as the initial choice especially in the light of sparse physicochemical databases. This is verified by the study of LR models on the simulated and real (glass) data. The performance parameters for fully-Bayesian setting are more robust to the size of database indicating that the uncertainty of population parameters ought to be included when sparse databases are at hand.

Zhu, Xiaochen
George Mason University, VA
Larry Tang, Elham Tabassi
Reproducibility of Statistical Forensic Methods: Logistic Regression and Kernel Smoothing

Existing statistical methods for estimating the likelihood ratio include parametric methods, kernel smoothing methods, and logistic regression methods. It has been an interest to study the reproducibility of these methods on face recognition datasets recently. The statistical aspects on these methods have been scarcely discussed although these methods have their own disadvantages and advantages. Some of these methods may not be valid unless the true genuine and imposter ratio is known. The sampling ratios between genuine and imposter groups have been largely overlooked. This article presents extensive simulation studies to investigate the reproducibility of the existing likelihood ratio methods when the sampling ratios are varied. The article also studies face recognition datasets with various sampling ratios regarding the reproducibility of the likelihood ratio methods.

Workshop Information

Both workshops will be held Tuesday, September 5 at the cost of $35 each and take place at the Minnesota Bureau of Criminal Apprehension (BCA), in St. Paul, MN. You can select to participate if you wish during registration or onsite.

Transportation will be provided from the University of St. Thomas and back. View the session schedule for departure times.
Workshop location - Minnesota BCA: 1430 Maryland Ave E, St Paul, MN 55106

Lunch will be on your own from 12-1:30 pm.

Morning Workshop - 8:30 - 12:00 pm
Elements of forensic science for statisticians
Organized by Dr. Glenn Langenburg, Ph.D. and Dr. Cedric Neumann, Ph.D.
This half day workshop is intended to introduce modern forensic analytical techniques and procedures to statisticians. During lectures and practical exercises, the audience will gain practical exposure to the recovery and analysis of different types of forensic evidence, as well as to the decision-making process that forensic analysists use to reach decisions on the source of traces. The workshop will also explore issues such as hierarchy of examination of multiple evidence types, and the combination of the results of conclusions from multiple evidence types. This workshop is primarily intended for statisticians, scientists and lawyers who recently became involved in forensic science and in evidence interpretation; however, more seasoned individuals will take advantage of the opportunity to see the deployment of forensic processes in a modern forensic laboratory.

Afternoon Workshop - 1:30 - 5:00 pm
Forum on communicating qualitative and quantitative evidence in forensic science
Organized by Dr. Glenn Langenburg, Ph.D. and Dr. Cedric Neumann, Ph.D.
This half-day forum will be dedicated to the presentation of qualitative and quantitative information (e.g., conclusions of forensic examinations, error rates) to stakeholders of the justice system (e.g., jurors, judges, lawyers, police, journalists, …). To initiate and guide the discussion in this forum, two panels will present and discuss different methods of presenting evidence. The first panel will include experts in communication, psychology, law and forensic science. These experts will share the results of research and experience, and discuss best practices for communicating information to lay individuals. The second panel will include lay individuals, judges, lawyers, and police investigators; panel members will offer their understanding of statistics and inferential forensic statements and offer insight on the data offered by the first panel. The audience will be able to interact with the two panels and react to their position. The members of the second panel will be surveyed in real-time to understand first-hand their position on various points raised by the first panel or by the audience. The intention of this forum is to expose the difficulty of presenting scientifically appropriate conclusions to lay individuals in a fair and balanced manner, while enabling a rational decision-making process in the recipient of that information, and to discuss a way forward.

Committees

A big thank you to everyone involved with organizing ICFIS 2017. Your commitment and dedication made this event possible. We appreciate you!

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Dr. Christopher Saunders   South Dakota State University
Dr. Glenn Langenburg   Minnesota Bureau of Criminal Apprehension
Dr. Mark Lancaster   Northern Kentucky University
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