

FOS: Probability and Statistics in Forensic Science

Programme Theme

While there have been dramatic advances in the range and scale of forensic techniques used to help solve legal cases, the way that the probative value of forensic evidence is presented in courts is rudimentary and often flawed. In particular, where probative value is presented in probabilistic and statistical terms there have been numerous instances of misunderstanding leading to miscarriages of justice. Yet there are emerging Bayesian-based probabilistic frameworks - for evaluating forensic evidence and combining it with other types of evidence – that have the potential to improve dramatically many aspects of the criminal justice system.

The programme will develop the main research topics in this area, such as the use of Bayesian networks for combining and evaluating multiple types of evidence, and statistical methods for DNA analysis, particularly in the difficult situations that arise in actual cases of forensic detection: mixed, low template or degraded DNA samples or rare Y-haplotypes. We will also examine the role statistical databases play in other types of trace evidence such as fibre analysis, soil analysis, and drug traces on banknotes.

The Programme will address the fundamental mathematical, statistical and algorithmic challenges in developing the methods to increase their reliability, and ensure their consistency and applicability to real cases. A small number of well known cases (in which probabilistic issues related to DNA and other types of evidence were critical) will be used as a common vehicle for developing and articulating the research. The programme will also address the problem of lack of consensus on methodology amongst the forensic community, and of conflicting, controversial and widely misinterpreted court authorities on the application and communication of the methods. The major barriers facing the optimal use of mathematics in the courtroom are on three levels: scientific, cultural, and communication. The Programme addresses all three types of barriers in an interdisciplinary manner, and includes both research and workshops that consider the problems of introducing the latest scientific knowledge to members of the forensic and legal professions and the task of communicating these ideas to the widest possible public.

A major goal of the programme is to produce a consensual set of guidelines specifying conditions under which specific techniques can be used to provide results and reliability estimates that are sufficiently certain to be presented in court without the risk of being challenged on appeal.