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Mathematical algorithm and the poll to reveal the criteria of the socially acceptable balance in judicial decisions taken using probabilistic data

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The precision of DNA identification with a certain locus set is typically measured with the frequency P of allele combination occurrence in a population. If the decision is made solely on the basis of DNA analysis results, it would always be the non-zero probability of justice failure due to mistaken identity. Therefore, for every case in hand we have to provide rationale for the critical value P_{max} of identification precision which can be assessed as sufficient for the judgment. We employ the notion of the average utility from the decision theory to obtain the closed form expression P_{max}=ln (1+x)/(V-1) where V is the estimate of the number of potential suspected persons and x=(a+b)/(c+d). Here 'a' is the utility gain when an offender is convicted, 'b' is the utility loss when an offender is acquitted, 'c' is the utility loss when an innocent is convicted by mistake; and 'd' is the utility gain when an innocent is acquitted. The value of 'x' reflects the adoption level by the society of justice failure in the considered case or a group of similar cases. The adoption level is a function of the society which needs to be elicited from a special poll. A possible question of the poll is the following decision problem: "Imagine you definitely know an innocent was convicted as a result of a justice mistake. You can secure an acquittal to this accused person but several convicted criminals (certainly guilty) will also be released from prison. How many criminals (1, 2, 5, 10 etc) would you release to save the innocent"? Then the maximum number 'n' of criminals released gives x=1/n. We provide examples of calculation of the critical frequency P_{max}.

Biography

Mikhail Goubko, a leading researcher in V.A. Trapeznikov Institute of Control Sciences of Russian Academy of Sciences and a Professor at the Moscow Institute of Physics and Technology (MIPT). He has PhD degree in technology (2003) and Doctor of Mathematics and Physics degree (2014) in discrete optimization and its applications. He specializes in solving applied problems of business and technology using optimization techniques, game-theoretic and cognitive models. He has more than 100 scientific publications and several books on formal methods in social and computer sciences. At MIPT he drives courses on game theory and discrete optimization in business administration.

Irina Perepechina, Professor of Department of Criminalistics of Legal faculty of Lomonosov Moscow State University. She has both medical and legal education, Ph.D degree (1990) and Doctor of Medicine degree (2003) in forensic medicine (genetic identification). Her scientific interests focus on forensic DNA analysis, DNA evidence interpretation, DNA database, DNA phenotyping, forensic serology; legal aspects, theory and methodology of forensic science/medical law. She has more than 140 scientific publications and manuals. A member of the International Society for Forensic Genetics (ISFG), INGO «Criminalists Congress»; in 1995-1999 - representative of Russian Federation in DNA WG of ENFSI. At the University Dr. Irina Perepechina lectures forensic medicine, criminalistics, forensic genetics, forensic science

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