An MSc project at the Netherlands Forensic Institute

Identification of gasoline from fire debris

Relevance for society

Arson is a crime with often devastating consequences, destroying property as well as killing people. Unfortunately, forensic investigation is hampered by the burning processes themselves, destroying most of the physical evidence.

Gasoline is the number one ignitable liquid used in arson. Gasoline traces may still be present at the crime scene. This allows, in principle, for linking of the gasoline traces to its source, for example a jerry-can with a gasoline residue found at a suspect. In approximately 50% of arson cases sent to the Netherlands Forensic Institute, gasoline is used as ignitable liquid. In some 30 cases per year, forensic experts in the Netherlands are asked to compare gasoline residues from an arson scene to some quantity of reference gasoline.

Evidence evaluation for inference of source questions

The state of the art in forensic science is to report on inference of source questions in the form of a likelihood ratio. A likelihood ratio is the ratio of two probabilities. These probabilities are the probabilities of the results of measurements (e.g. similarities and differences between a trace from a crime scene and a reference from a suspect) given each of two competing hypotheses (e.g. H1: trace is from the reference, H2: the trace is from a different source). A big driver for research in the field is the quest to develop numerical, computer assisted methods to compute likelihood ratios[1–6].

Innovation

Recently, the size of datasets to train statistical models to compare gasoline residues to gasoline-in-fire debris residues has grown [7]. This allows for the application of deep neural networks.

MSc project

This is a nice project for a MSc. student specializing in Artificial Intelligence or likewise. The challenge for the student is to

1. Generate a large simulated dataset based on real data: computer mixtures of real data on burned substances (carpet, wood, etc.) and data on evaporated gasolines.
2. Train and design a neural network for inference of source of gasoline in fire debris.

The outcome of the neural network may support arson experts in linking gasoline in possession of a suspect to gasoline that has been used for fire setting.

Contact information

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