

Chapter 69

Optimization of Crime Scene Reconstruction Based on Bloodstain Patterns and Machine Learning Techniques

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ABSTRACT

Crime scene reconstruction based on circumstantial evidence and bloodstain patterns at the scene is often affected by unwanted expert bias. Using features such as bloodstain pattern, wound analysis, size of bloodstains on objects etc., predictions could be made about the relative position of the victim/s, bystander/s and perpetrator/s. Supervised learning techniques can be used to make predictions related to the murder weapon used. Gender of an individual could also be estimated from the bloody broken plastic footprint of an individual using a suitable dataset and supervised classifier. These intermediate prediction modules are important for development of event segments. The event segments add up towards the development of the events that transpired at the crime scene. An optimal sequence of events that might have transpired at the crime scene could thereby be developed using event timestamp and logical sequencing of similar incidents that had occurred in the past using probability theory.

INTRODUCTION

Herbert McDonnell once said, “In the course of a trial, both defense attorneys and prosecuting attorneys may lie, witnesses may lie, and the defendant certainly may lie. Yes, even the judge may lie. Only the evidence never lies. But if the evidence is not properly recognized, documented, preserved and processed all we have are attorneys, witnesses, defendants and judges” (Nordby, 2006)

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In line with the quote by McDonnell, the authors like most other forensic analysts do believe that when reconstructing a crime scene, physical evidence unlike attorneys, witnesses and defendants cannot lie. However, physical evidence requires/warrants proper collection, documentation, preservation and most importantly proper interpretation by forensic analysts.

The trial of Dieter Riechmann, a German national who has been imprisoned at the Florida State Prison in Raiford for 25 years, went particularly wrong owing to uncertainties in a forensic report (Thadeusz, 2012). Riechmann and his girlfriend of 13 years, Kersten Kischnick, were driving through Miami in a rental car on the evening of Oct. 25, 1987 while on vacation (Thadeusz, 2012). As per Riechmann's account, she was seated in the passenger seat, and was shot in the head by a black man whom she had asked for directions (Thadeusz, 2012). Riechmann also claimed to have witnessed the crime, the death of his girlfriend, from the driver's seat. Reichmann's account was questioned by a Government forensic expert on the pretext that if he(i.e. Reichmann) was seated on the driver's seat, Kersten's spattered blood could never have reached the inside area of the driver's door(Thadeusz,2012). The argument put forward by the expert was based on the assumption that the trajectory of spattered blood is straight (Thadeusz, 2012). However, as of date it has been scientifically established that the trajectory of spattered blood is not straight but curved (Thadeusz, 2012).

In 1954, Marilyn Sheppard, the wife of a promising surgeon, Sam Sheppard, was beaten to death in her bed(Thadeusz,2012). Given that Sam had a reputation of being a philanderer, he was considered to be the prime suspect in the Marilyn Sheppard murder case (Thadeusz, 2012). Discovery of a piece of blood-soaked material did not particularly help Sam Sheppard's case, as investigators claimed to have identified impressions of surgical tongs on the blood soaked cloth(Thadeusz,2012). However, now experts know for a fact that the marks on the bloodstained cloth that was misconstrued as impressions from surgical tongs were actually caused due to creases in the cloth (Thadeusz,2012).

The interpretation of bloodstain patterns at a crime scene in coherence with the other physical evidence located at the crime scene can indeed greatly influence juridical decisions with respect to any criminal offence. As Dr. Brodbeck(2012) puts it, "A technically incorrect expert report can make the difference between conviction and acquittal."

Herein lies the necessity for objectivity in the process of crime scene reconstruction using physical evidence, bloodstain patterns in particular. Interpretation of physical evidence is often tinted by unwanted, unintentional human bias, use of statistical techniques, scientifically re-creatable logical reasoning help eliminate subjectivity and minimize human bias in the process of reconstruction of crime scenes.

This chapter is largely dedicated to provide a general understanding of crime scene, and how these stain patterns could be used for reconstructing a crime scene. The chapter is aimed towards suggesting a scientific objective methodology for crime scene reconstruction by using bloodstain pattern interpretation in coherence with other relevant physical evidence present at a given crime scene.

BACKGROUND: BASIC TERMINOLOGY AND CLASSIFICATION

Bloodstain Pattern Analysis particularly involves careful scientific study of the static consequences resulting from dynamic bloodletting events (Nordby, 2006). The detailed documentation of bloodstain patterns present at a crime scene often prove to be an 'evidence of great importance' within the courtroom setting. Bloodstain pattern analysis deals with careful study of the distribution, shape, size of bloodstains on a victim, on a suspect, on the floor, on the walls, on the ceiling, on objects at the crime

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