Andrew Zysk 9/11/2016

Senior Design Project Summary

Project Overview

The purpose of this Senior Design Project is to create an image processing software application for crime scene investigation. The intended user, a forensic scientist, would use the application to upload images of crime scene evidence (e.g. blood stains, debris) and automate the forensic process of bloodstain pattern analysis. Modules of the project are defined as terms in the following list:

- A ***mobile application*** for iOS and Android, where the user may upload images from a smartphone camera.
- Software ***infrastructure*** that provides back-end Java code to analyze an image, and transfer data from the web application to a database.
- An ***algorithm*** that outputs an analysis of the image from the input requests of the user, or automatically when no input is provided.

Intellectual Merit

This Senior Design Project will gain most of its intellectual value from the image processing algorithm to be devised. Technical challenges will be faced at each defined project module. Developing an effective algorithm will require technical hurdles, as the algorithm must recognize the physical components (e.g. walls, surfaces) of a crime scene in addition to analyzing it. The primary goal of R&D, which is crucial to the innovation of the project, is the effectiveness, usefulness, and accuracy of the algorithm. The high-level plan for R&D is to research effective methods for computer image processing, and to research established forensic image analysis processes that can be automated. Development of the mobile application and infrastructure will require technical knowledge in iOS and Android development, and cross-platform development.

Broader Impact

This Senior Design Project will yield a useful, automated solution for forensic scientists and other crime scene investigators. Therefore, the proposed application will have potential for commercialization. The proposed application can be used as a tool to compare against forensic results, or it can be used as an unbiased, unambiguous third party in a case analysis. An algorithmic image processing solution will allow crime scene investigators to pursue a deeper analysis of their cases, and it will consequently increase the probability that a case analysis of a crime scene verifies the unequivocal truth. To that end, the innovation and commercialization of the project will provide a net benefit to society.

Project Summary (Revised)

Project Overview

The purpose of this Small Business Innovation Research Phase I project is to create an image processing software application for crime scene investigation. The intended user, a forensic scientist, would use the application to upload images of crime scene evidence (e.g. blood stains, debris) and automate the forensic process of bloodstain pattern analysis. Key modules of the project are defined as keywords in the following list:

- A ***mobile application*** for iOS and Android, where the user may upload images from a smartphone camera.
- An ***algorithm*** that outputs an analysis of the image from the input requests of the user, or automatically, when no input is provided.

Intellectual Merit

This Small Business Innovation Research Phase I project will gain most of its intellectual value from the image processing algorithm to be devised. Technical challenges will be faced at each defined project module. Developing an effective algorithm must overcome technical hurdles, because the algorithm must recognize the physical components (e.g. walls, surfaces) of a crime scene in addition to analyzing it. The primary goal of R&D, which is crucial to the innovation of the project, is the effectiveness, usefulness, and accuracy of the algorithm. The high-level plan for R&D is to research effective methods for computer image processing, and to research established forensic image analysis processes that can be automated. Development of the mobile application and infrastructure will require technical knowledge in iOS and Android development, and cross-platform development. As the topics of mobile interfaces and data analytics have received massive attention from businesses and researchers in the past few years, they have become the new standard in application development. Overcoming the aforementioned technical and algorithmic challenges in mobile development and forensic science processes, respectively, will yield a user-friendly application that is effective, lightweight, and useful in analyzing crime scene data.

Broader Impact

This project will yield a useful, automated solution for forensic scientists and other crime scene investigators. Therefore, the proposed application will have potential for commercialization. The proposed application will be used as a tool to compare against forensic results, or it can be used as an unbiased, unambiguous third party in a case analysis. An algorithmic image processing solution will allow crime scene investigators to pursue a deeper analysis of their cases, and it will consequently increase the probability that a case analysis of a crime scene verifies the unequivocal truth. Because it will automate existing forensic processes, the proposed application will allow forensic scientists to spend their time more efficiently by researching and analyzing other data. Furthermore, this project will encourage industry innovators to automate data analysis processes. This approach to data analytics will be helpful in the future because organizations currently have more data than they are able to effectively analyze. To that end, the innovation and commercialization of this project will provide a net benefit to society.

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9/25/2016

Elevator Pitch

The expected customer of the application is a crime scene investigation professional (e.g. forensic science experts, detectives) who captures or analyzes photos of crime scene evidence. The primary customer need that will be addressed by the application is a demand for automation of existing analysis processes. In the current era, organizations obtain more data than they are able to effectively analyze. The proposed application will automate forensic science processes on a given photo. Therefore, a crime scene investigation organization that uses the application will have a better opportunity to allocate its resources to another project or analysis task. Automation of the forensic analysis process will also provide an unbiased, third-party solution to a criminal case, and thereby increase the probability that the results of a case reflect the truth.

The value of the proposed application will be generated from the innovation of its algorithmic component. Increasing the effectiveness, accuracy, or usefulness of the algorithm will directly increase the benefit of the application to the customer. The application will be as valuable as its ability to apply existing forensic processes. Another key differentiation of the application will be its ability to interface with the user. The application will allow the user to make his or her own decisions in analyzing an image, because the intended user is a professional in the field of crime scene investigation. The user will be able to focus on specific parts of an image, and apply automated processes of his or her choosing.

The purpose of this project is to create an image processing mobile software application for crime scene investigation. The proposed application will serve as an analysis tool for the intended user: a forensic scientist or other crime scene investigator. The intended purpose of the application is to take photos, with a mobile device, of crime scene evidence, such as blood stains and debris, as input, and to output an automated analysis based on the inputs of the user. The proposed application will automate existing forensic analysis processes, such as bloodstain pattern analysis, in order to increase the effectiveness, accuracy, and expediency of the crime scene investigation process.

This application will advance the field of crime scene investigation by applying existing processes to an efficient and lightweight mobile software application. Applying concepts from mobile development, data analysis, and algorithmic problem-solving to the field will allow for deeper analysis of crime scene evidence. Furthermore, this project will encourage industry innovators to explore new approaches to the utility of mobile interfaces, and the automation of data analysis processes. This project will also apply emerging image processing concepts to a field that can benefit greatly from them. In its direct application of new concepts, and in its indirect encouragement of new approaches to solving problems, this project will benefit innovators in the field of crime scene investigation, as well as innovators that seek to apply the same concepts.