

## Privacy-aware gun-shot detectors

### Background:

Systems for crime prevention today mostly rely on CCTV security cameras. In a city like London, it is estimated that there are more than 900,000 cameras, with around 21,000 cameras operated by the UK government<sup>1</sup>. It is estimated that a normal person in London is captured on average on 70 cameras per day. With some new suggestions that Sweden should follow suit, installing cameras for crime prevention, this is a privacy concern. In fact, while some researchers find some gains from using video surveillance in reducing crime when coupled with other intervention measures<sup>2</sup>, they also acknowledge that they come at a non-negligible cost economically and from a privacy point<sup>3</sup>.

One less intrusive solution are so-called "gun-shot detector systems". Whenever there is a gun-crime incident, it is of paramount importance that first-responders are notified as fast as possible. Today, these reports mostly depend on getting calls from people who hear gunshots. Recently, there has been a surge in gun-shot detection systems installed around the world to speed-up the reports to the first responders. These systems have proven to be very effective in many countries while being less intrusive compared to cameras. These systems rely on deploying **acoustic sensors** in areas, running Machine learning algorithms to identify gun-shots<sup>4</sup>, and trying to localize the source of the sound<sup>5</sup>.

However, with the prevalence of mobile phones, one can think that phones can act as the acoustic sensors for detecting gun-shots. We want to investigate the feasibility of this.

### Project Description

Similar to you saying "Hello Google" and your phone connecting you to the Google Assistant, we would like to build an App that gets activated when a gun-shot is detected. The App should then activate a network connection to phones in its vicinity to exchange information and verify that other phones also detected the gunshot. The phones should then try to localize the source of the gun-shot<sup>6</sup> and possibly take an electronic snapshot of bluetooth / wifi in the vicinity.

**Literature suggestions:** See footnotes

**Target Group:** DV, D, IT and EE. The report can be written in either English or Swedish, with a slight preference for English.

**Special Prerequisites:** The project will involve mobile-App developments, ML algorithms, and some signal processing. The student group should strive to complement each other.

<sup>1</sup> <https://clarionuk.com/resources/how-many-cctv-cameras-are-in-london/>

<sup>2</sup>

[https://bra.se/download/18.c4ecee2162e20d258c421a8/1530605772865/2018\\_CCTV\\_and\\_Crime\\_Prevention.pdf](https://bra.se/download/18.c4ecee2162e20d258c421a8/1530605772865/2018_CCTV_and_Crime_Prevention.pdf)

<sup>3</sup> <https://cebcp.org/evidence-based-policing/what-works-in-policing/research-evidence-review/cctv/>

<sup>4</sup> Welsh, David, and Nirmalya Roy. "Smartphone-based mobile gunshot detection." *2017 IEEE international conference on pervasive computing and communications workshops (PerCom workshops)*. IEEE, 2017.

<sup>5</sup> Klein, Daniel J., et al. "Localization with sparse acoustic sensor network using UAVs as information-seeking data mules." *ACM Transactions on Sensor Networks (TOSN)* 9.3 (2013): 1-29.

<sup>6</sup> <http://ras.papercept.net/images/temp/IROS/files/1414.pdf>