Final Project 2023

Project Outline

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Title Proposals

- "Using computer vision and AI techniques to improve crowd safety management"
- "Improval of crowd safety using computer vision and possibly various AI aspects"

Administrative Info

Collaborators from Event Safety

- Sofie Dahl, sofie@eventsafety.dk
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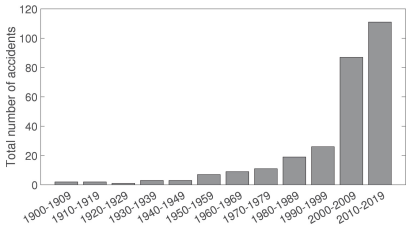
SDU supervisor

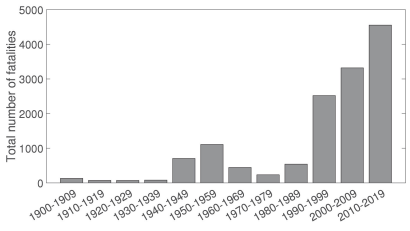
- Sune Lundø Sørensen, slso@mmmi.sdu.dk

Context and Background

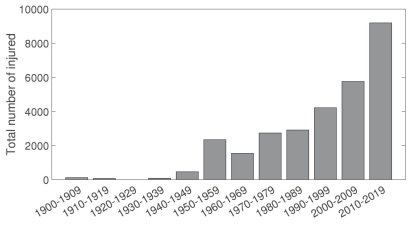
As seen from Figure 1 accidents, fatalities and injuries at festivals and concerts worldwide are on the rise, with just below 5,000 worldwide deaths in the decade of 2010-2019. This can be attributed to several causes, according to Raineri (2004): First of all, an increase in popularity for outdoor music festivals resulting in more and larger festivals with large crowds. Also, high-risk behavior among crowd attendants and the performing artist's music, behavior, and stage show affects the crowd's safety. Cultural influence has also played a large part in the safety of outdoor musical events. This can be behavior such as crowd surfing, moshing, stage diving and the like. Sudden panic at a crowded place can thus affect the safety of the crowd. Generally, it has become more dangerous to attend these festivals since the 70s.



(a) Accidents by decade



(b) Fatalities by decade



(c) People injured by decade

Figure 1: Fatalities in crowds graph (Figure from Feliciani et al. 2023)

At the same time, festivals in Denmark and the rest of the world have had a focus on mitigating the safety risk in large crowds. This can be seen by the establishment of the Event Safety Foundation in 2015. This is a joint venture between the Skanderborg Festival Group (Smukfest) and Muskelsvindfonden (Grøn Koncert). This foundation has the purpose of securing the safety of the crowds at these two large Danish festivals, as well as many other events in Denmark. They do this through knowledge sharing, professionals and trained volunteers, courses and counseling. This is the company that this project will be done in collaboration with.

In order to be able to have the best possible outcome for this project, Event Safety invited us to Grøn Koncert and Smukfest in July and August to see how they work and gather security video footage of real crowds at festivals to use as training data. We will also use Event Safety for their practical and theoretical knowledge of crowd safety to use in the system, user feedback and user testing.

Problem Statement

Can computer vision software and AI techniques be leveraged to improve crowd overview for security guards, by receiving video feed from large crowds, and ultimately improve crowd safety?

Solution Proposal

Using cameras mounted around a hotspot of a crowd or on a stationary drone, we aim to develop a platform where a machine learning model receives live footage from these cameras, uses the model to segment the crowd, and learns what a dangerous situation might look like. This could be one or more of the following (Raineri 2004):

- Several people moving into the crowd from a specific direction create a dangerous pressure point
- More than a specified amount of people in a marked area resulting in unsafe conditions (ie. >6 people per square meter)
- Omnidirectional or directional movement in the crowd resulting in a dangerous situation
- An area in the crowd suddenly being void of people, perhaps hinting at a mosh pit or an emergency

These are some of the situations this project aims to systematically detect and alert professionals by providing meaningful feedback.

The system would consist of the following:

1. A backend that receives the data from the cameras developed in either Java or Python, with an implementation of a machine learning model to handle the video feed according to the bullet list above and exposing this data through an API
2. A simple frontend or GUI (Graphical User Interface) to display this information in a meaningful way. This could be through a heat map, a numerical estimate of a risk factor, or other visual output.

An intial component diagram that maps this described system can be seen in (**component-diagram?**)

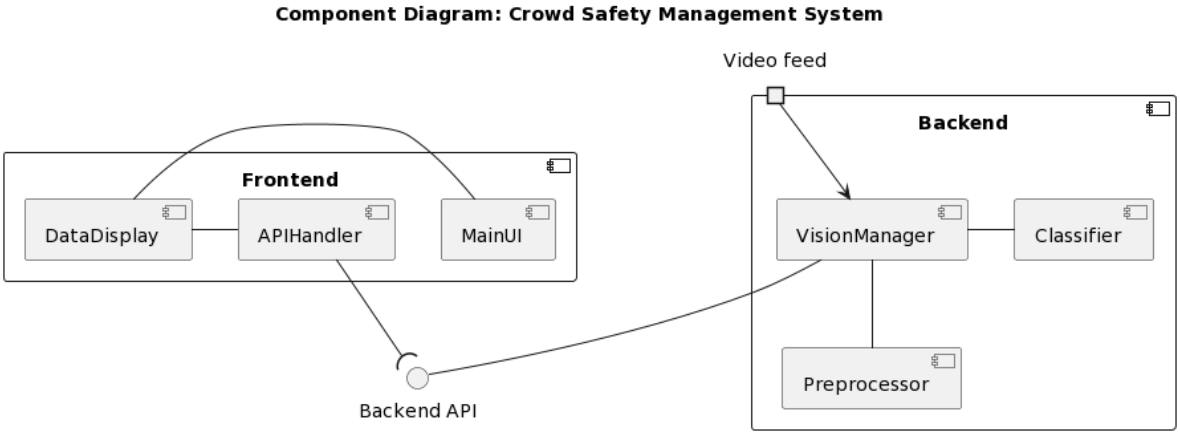


Figure 2: Component diagram of the system

References

Feliciani, Claudio, Alessandro Corbetta, Milad Haghani, and Katsuhiro Nishinari. 2023. "Trends in Crowd Accidents Based on an Analysis of Press Reports." *Safety Science* 164: 106174. https://doi.org/https://doi.org/10.1016/j.ssci.2023.106174.

Raineri, Aldo. 2004. "The Causes and Prevention of Serious Crowd Injury and Fatalities at Outdoor Music Festivals." In. https://doi.org/10.13140/2.1.3036.0005.