

Thesis Project Portfolio

Pitch Controlled Pong

(Technical Report)

Limiting Privacy Incursion from Facial Recognition through De-identifying Face Images in the Public Domain

(STS Research Paper)

An Undergraduate Thesis

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Introduction

While my STS research paper and technical project are not directly related, both highlight my interests and skills within the fields of computer science and electronics engineering. My STS research paper focused on techniques to anonymize face photos from facial recognition while retaining photo quality. My technical capstone showcased a diverse range of skills by implementing a game of pitch-controlled Pong on an embedded device.

Project Summaries

In my STS research, I explored technologies to obfuscate people's identities and other sensitive personal information from images while maximizing quality and photo-realistic nature. This investigation centered explicitly on protecting individuals from privacy incursions relating to facial recognition. I examined current facial image de-identification techniques such as differential privacy, GAN-based inpainting, and adversarial examples (AE). I reviewed the recently published academic research that refines these AE-based protection methods to provide minimal changes to the image while proving effective against facial recognition algorithms using advanced deep neural networks. This paper concluded that these de-identification techniques are limited by their lack of variability – preventing the user from determining the tradeoff between protection and photo quality. This lack of variability precludes the widespread acceptance of de-identifying face images uploaded to the internet, hindering individual privacy.

I completed the technical portion of my thesis through the Electrical and Computer Engineering department. My capstone team created pitch-controlled Pong. This involved constructing a physical single-player video game module with vocal controls. The module runs a

version of the classic game Pong with a twist. The user moves their paddle up and down based on the pitch of their voice. Based on an initial calibration, the user sings a relatively high-pitched note to move their paddle up, and a relatively low-pitched note to move their paddle down. The opponent is a computer-controlled paddle on the opposite side of the screen. The module consists of a small monitor in a display console with an external microphone for the user to vocalize their input. This project culminated with a presentation of our working prototype to students and faculty in the Engineering School.

Conclusion

Although the projects were dissimilar, they provided me with valuable technical and research skills. The pitch-controlled Pong project enabled me to demonstrate several electrical and computer engineering skills acquired throughout the CpE course sequence. This project also gave me valuable experience producing technical reports and presenting research to audiences made up of both peers and experts. These skills proved invaluable when writing my STS research paper. My engineering background helped me to comprehend the technology behind image de-identification techniques and evaluate their shortcomings and overarching societal impact. The privacy considerations enumerated in my STS research emphasize the power engineers have and highlight the importance of broader considerations when making design decisions.

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