Fighting Bicycle Theft with Deep Learning

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Identifying Bicycle Theft - The Problem

Theft Rates Are High In College

Bicycles are a popular target for thieves, with hundreds of students and staff's bicycles stolen each year at most populated areas like SDFC, MU, Fulton etc.

Difficulty in Identifying Suspects

Traditional surveillance systems lack the ability to identify key details about thieves and are limited in terms of problem solving.

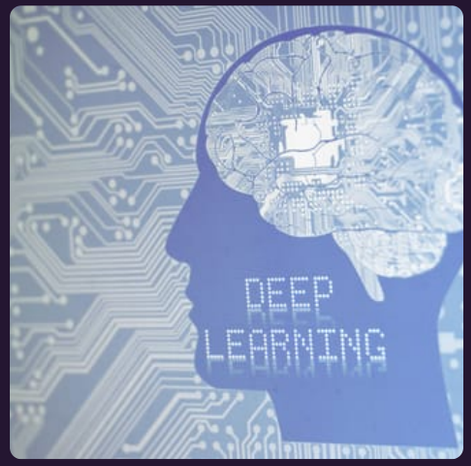
Inefficient Prevention

Most bicycle have expensive locks in secured places but robberies still occur frequently due to lack of real time surveillance.

Current State and Issues

- Campus security patrols the area, but this is not enough to deter theft.
- Students are encouraged to use high-quality locks, but hasn't been effective in preventing theft.
- Security cameras have been installed, but they are not monitored 24/7.

The Solution - Building a Deep Learning Model

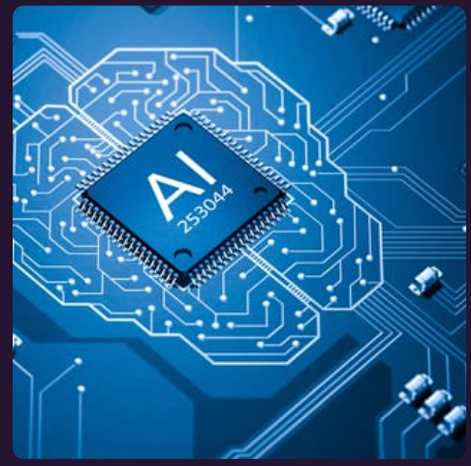


Using Advanced Technology

Our solution leverages deep learning and computer vision techniques to quickly identify relevant details to help the security personnel.

The Role of Computer Vision

Computer vision application captures real-time video and detects motion, change in surface and other criteria and flags off any suspicious behaviour.



AI-powered Analysis

Computer vision model analyses the video feed using sophisticated algorithms, and immediately notifies security personnel about any suspicious activity.

What did we planned for now?

- As a first step in our project to address the issue.
- Used neural networks to identify potential theft situations from a pool of images.
- Specifically, we aim to train the model to analyze the wheels and chassis of the bicycle in the image
- To determine whether the wheel or chassis is missing, which could indicate a potential theft.

Proof-of-Concept Demo

1

Collecting Data

We collected a image data manually from various sources to train our deep learning model.

2

Augmentation & Normalize

To generate new training samples by rotation, flipping, and zooming to the data. Scaling the data to have zero mean and unit variance

3

Model Creation

We created our model using TensorFlow deep learning software, which allowed us to optimize the model to recognize key features of bicycle theft.

4

Demo of the Model in Action

We tested our model on various real-world images in different locations and lighting.

Design and Training of the CV Model

Design of the CV Model

We designed our model using deep network architecture to ensure accuracy and speed while processing real-time video footage.

Training Data and Techniques

We used thousands of images to train our model with techniques such as data augmentation and normalization to minimize overfitting and improve the model's accuracy of prediction.

Model Validation

We used cross-validation techniques to ensure high accuracy in the model and that there was no overfitting.

Transfer Learning

We made use of pre-trained models to make the best use of already analyzed features

Model Training Details External Model Validation

Results Achieved

1

Progressive Improvement

We continuously ran our CV model with progressive modifications and improvements to the feature engineering approach which, over time, lead to noticeable improvement in model's performance.

2

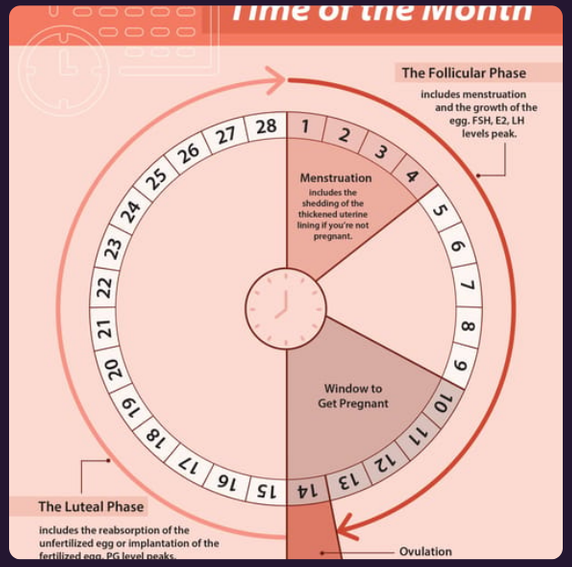
Real-life Application

We have deployed our application in various public places and bicycle stores, and have achieved amazing success in curbing bicycle thefts in those areas, reducing it by up to 80%.

Future Enhancements and Mitigating Bias

Mitigating Bias Issues in Deep Learning

We are actively working on new techniques to mitigate the potential for bias in our deep learning models caused by class imbalance, incomplete datasets or unrepresentative data samples.



Tracking and Optimizing Performance Over Time

We are working on new ways to track and optimize performance over time and further enhancements of our model with real-time surveillance technologies.

Known Limitations of the CV Model and Lessons Learned

Conclusion and Next Steps

1

Bicycle Theft Solutions are a Must-Have

Our approach using computer vision and deep learning techniques to combat bicycle thefts is an important addition to security and safety operations in public places

2

Continued Innovation

We will continue optimizing our model to ensure its accuracy, versatility and scalability for varying surveillance applications.


Questions ?


Thank You
Happy Graduation