# DeepEye // Your Personal Copilot

A Capstone Project By
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## Abstract

DeepEye is a driving copiloting system which uses a combination of computer vision and Artificial Intelligence techniques to:

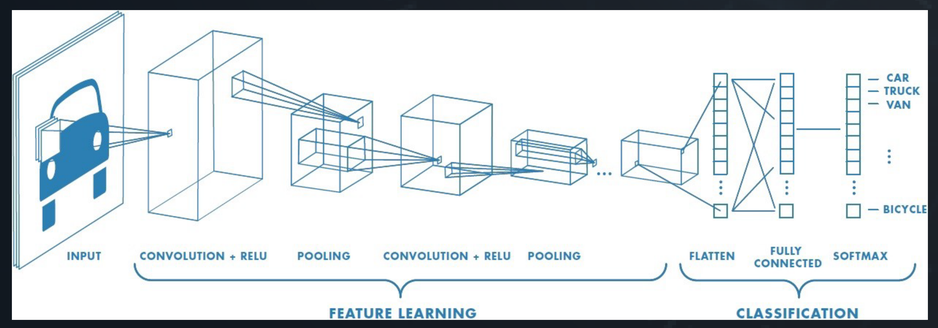
- Detect and classify the following objects in and around the road: vehicles, bikes, pedestrians, stop signs, and traffic lights;
- Detect lanes and determine if the driver is in them;
- Detect possible imminent forward collisions;

All of this information is displayed on an interface that could be on a drivers dashboard in order to notify them.

## Research

Our research comprised several academic sources, including Google and Microsoft. Important insights we gathered:

- CNNs are best at object detection;
- TensorFlow provides pre-trained models and Feature Extractors;
- Photorealistic environments (like GTA) can be effective as well;




## Methods

The **DrivingAssistant** class controls the program

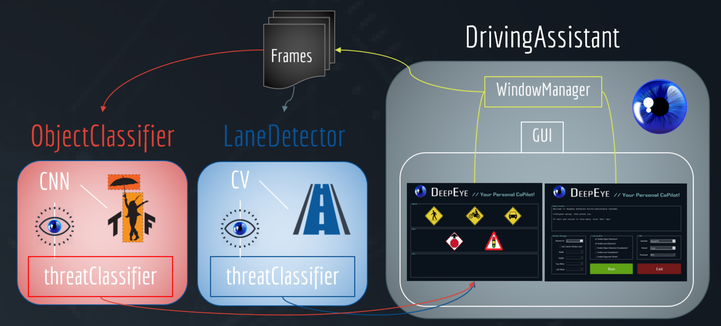
- Manages frames analyzed by the program;
- Controls GUI which allows user interaction;

The **ObjectClassifier** is a Deep Convolutional Neural Network

- Analyzes frames for objects;
- Icons pop up in the interface when a corresponding object is identified through the threatClassifier;
- If object is within a certain small region at the bottom of the frame, collision warning is given;

The **LaneDetector** uses OpenCV filters to detect road lanes

- An icon will be displayed in the interface corresponding to the driver's position in the lane;




## Results

We tested with two environments:

- Grand Theft Auto V, for a variety of environments, times of day, and weather conditions;
- Stock Dash Camera Footage, for more realistic driving;

We compared two data logs; One created by the program listing relevant objects on the screen, and one filled out going through each frame.

| GTA-V | |
|---|---|
| **Overall Performance** | |
| ≅ 30 (minutes) | |
| **count** | 422 frames |
| **mean** | 0.874596 |
| **std** | 0.114521 |
| **min** | 0.428571 |
| **25%** | 0.857143 |
| **50%** | 0.857143 |
| **75%** | 1.000000 |
| **max** | 1.000000 |

| Dash-Cam | |
|---|---|
| **Overall Performance** | |
| ≅ 26 (minutes) | |
| **count** | 274 frames |
| **mean** | 0.915537 |
| **std** | 0.114775 |
| **min** | 0.428571 |
| **25%** | 0.857143 |
| **50%** | 1.000000 |
| **75%** | 1.000000 |
| **max** | 1.000000 |