SELF-DRIVING cars using GTA and DEEP LEARNING

@rudigrobler

v1.0.6

Lightstone

We simplify the complex

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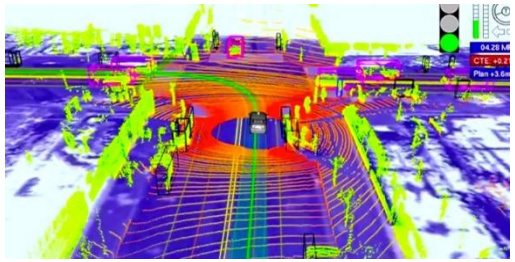
Self-driving

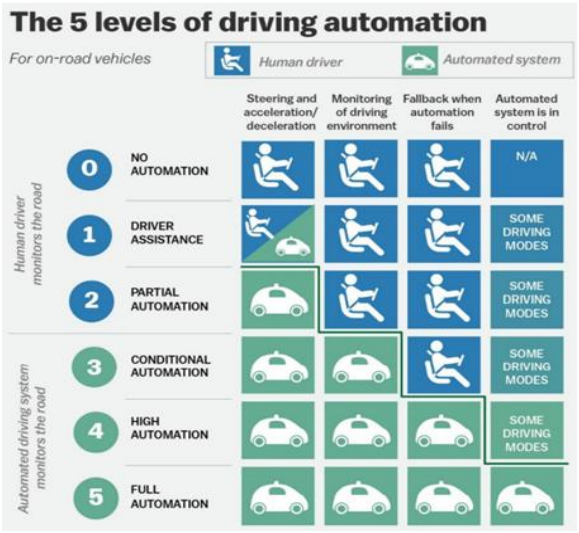
- **It's hard,** but possible
- **Many approaches**, and techniques
- **Companies**, People

What is Self-driving?

"A self-driving car, that is, a ground vehicle that is capable of sensing its environment and moving safely with little or no human input."

~ Wikipedia





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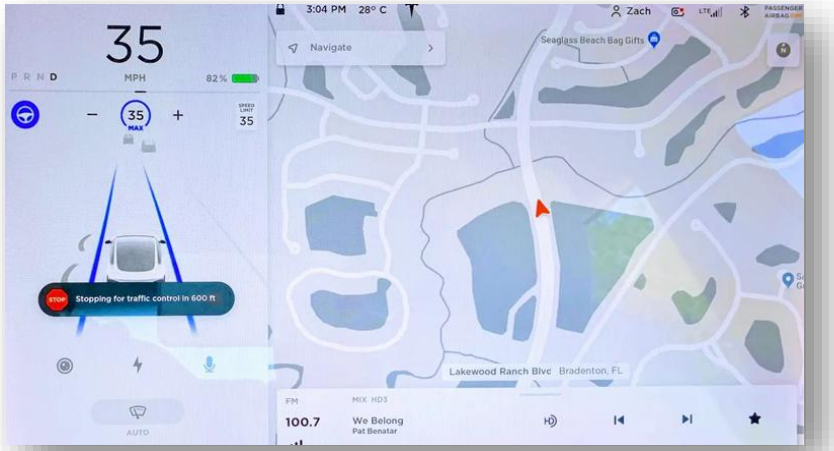
Self-driving

Tesla
Autopilot

comma.ai
openpilot

Waymo



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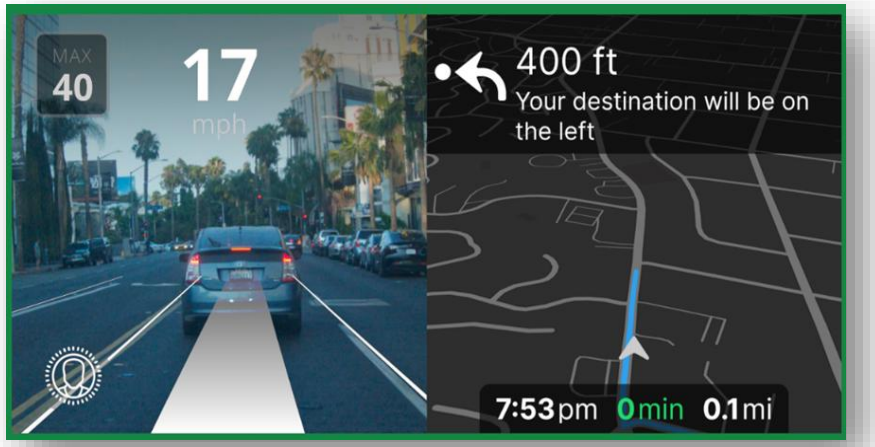

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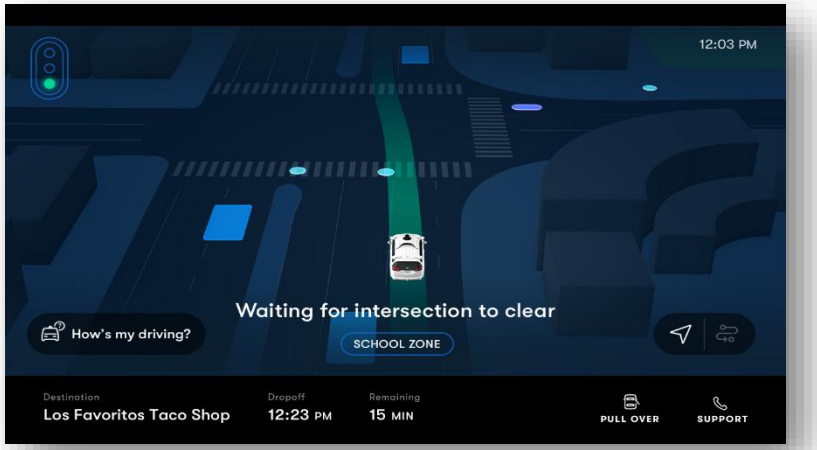

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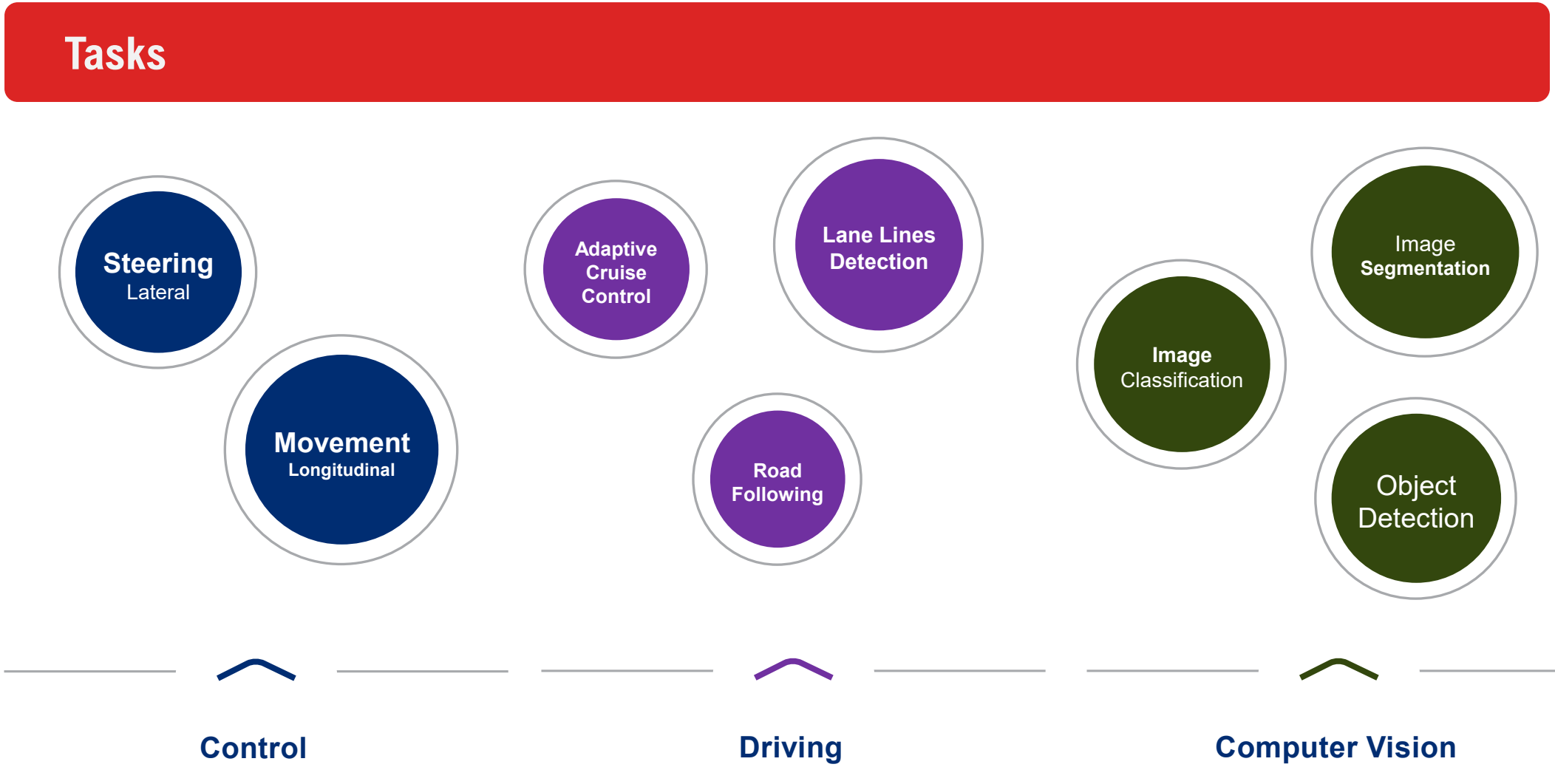
Self-driving



Sensors

- **Vision:** Camera, wide street to driver monitoring
- **Perception & Localization:** What's around us
- **Motion:** IMU, gyroscopes, and accelerometers
- **The car:** Speedometer, GPS, maps

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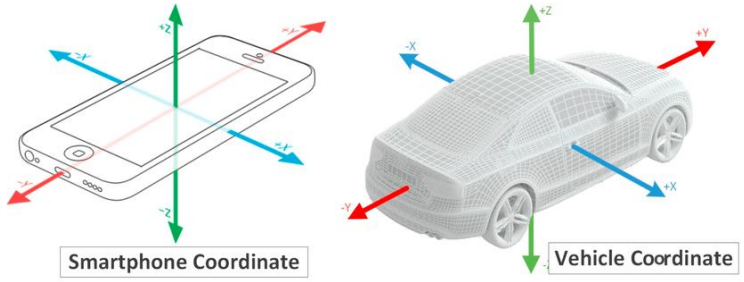

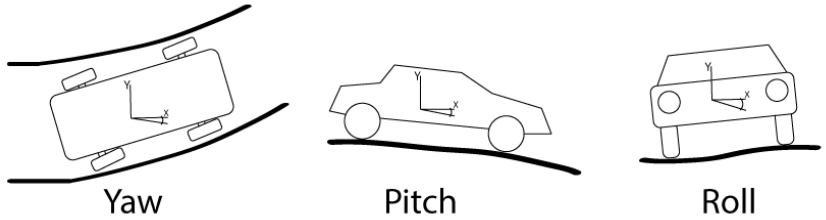

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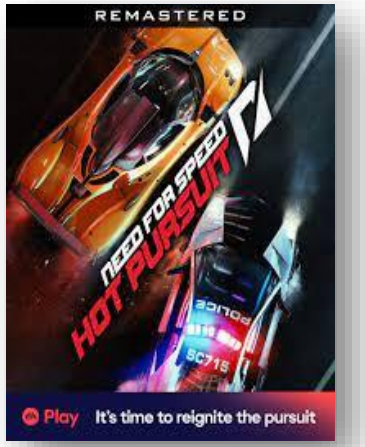
Could have been **ANY** game



GTA

- **Why GTA?**
  - **Its mod-able**
- **Open world,** and realistic
- **Fewer humans to hit**, but…
- **Fun**, fun, fun

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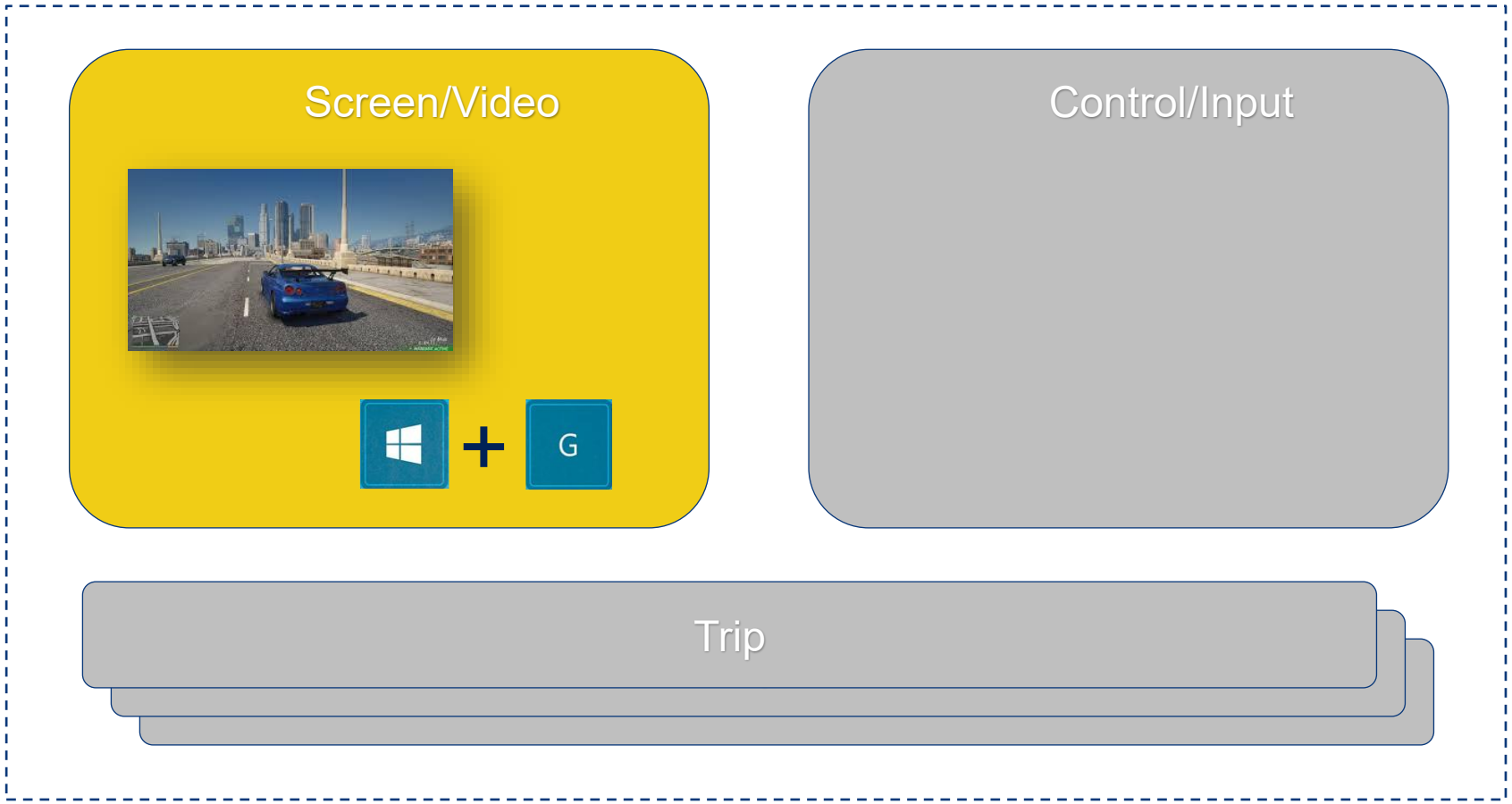
GTA



Demo

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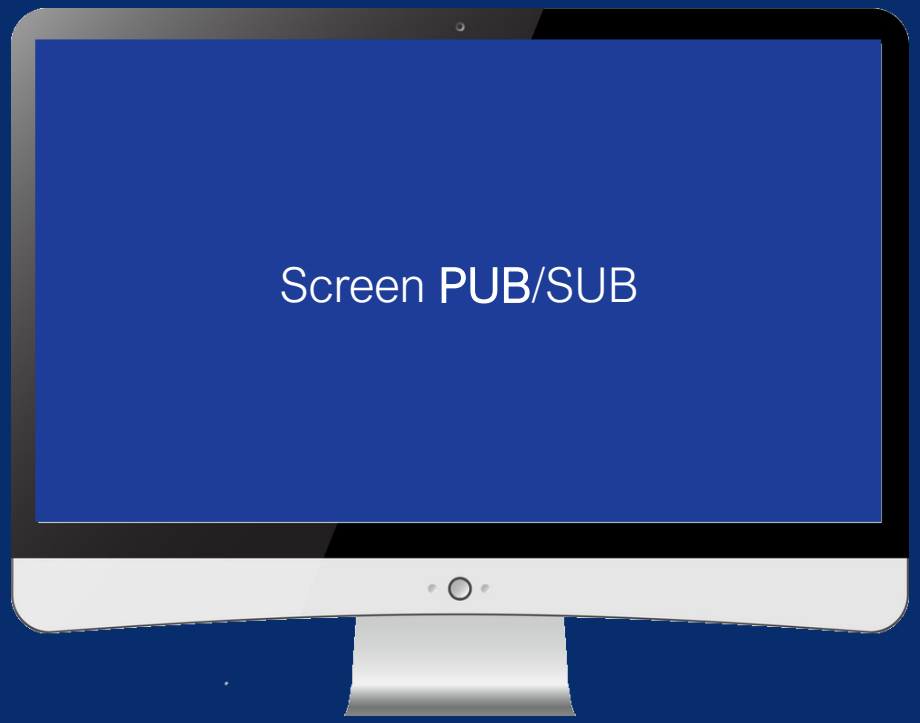


GTA

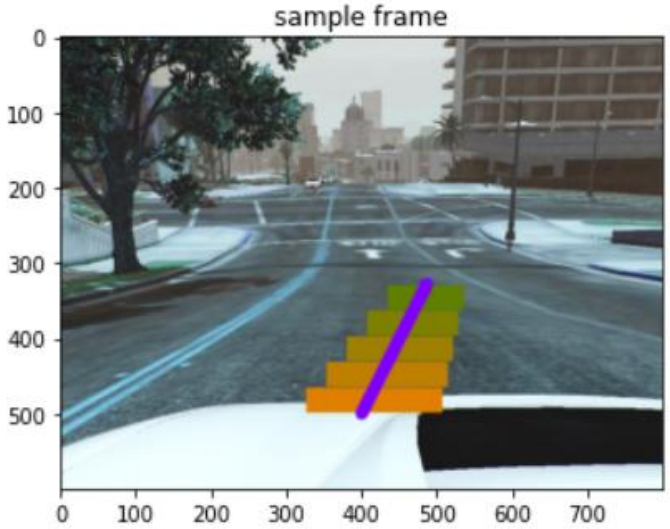
Screen/Video

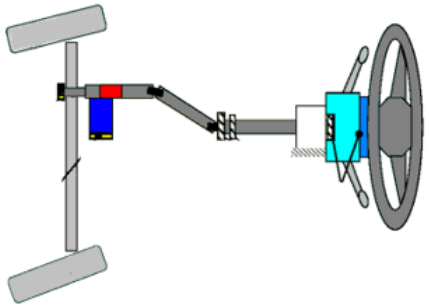
Control/Input

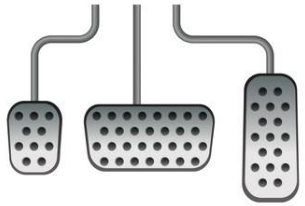
Trip

- **Just recording control**, not enough!

- **Car State**
  - Speed
  - Steering Angle
  - Throttle & Brake







- **A ScriptHookV script**
  - **Car State**
    - Speed
    - Steering Angle
    - Throttle & Brake Power
- **Very flexible and easy,** can get back fuel & oil levels. Engine health, rotation, location, and much-much more

Demo

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crosire / scripthookvdotnet

Public

Notifications Fork 355 Star 825

main 3 branches 50 tags

Go to file Code

crosire Regenerate NuGet API key ✓ d9275ee on Jan 17 2,476 commits

.github/ISSUE_TEMPLATE	Add GitHub issue templates	3 years ago
examples	Fix ExitVehicle example failing when player is warped out of vehicle	3 years ago
sdk	Initialized repository	7 years ago
source	Update version	3 months ago
tools	Update native hashes using new database	3 years ago
.editorconfig	Change editor config to only apply to source code files	3 years ago
.gitignore	Add "intermediate" directory to ignore file	13 months ago

About

An ASI plugin for Grand Theft Auto V, which allows running scripts written in any .NET language in-game.

hook scripting gta5 net-languages

Readme
Zlib License
825 stars
93 watching
355 forks

Demo

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GTA

Screen/Video

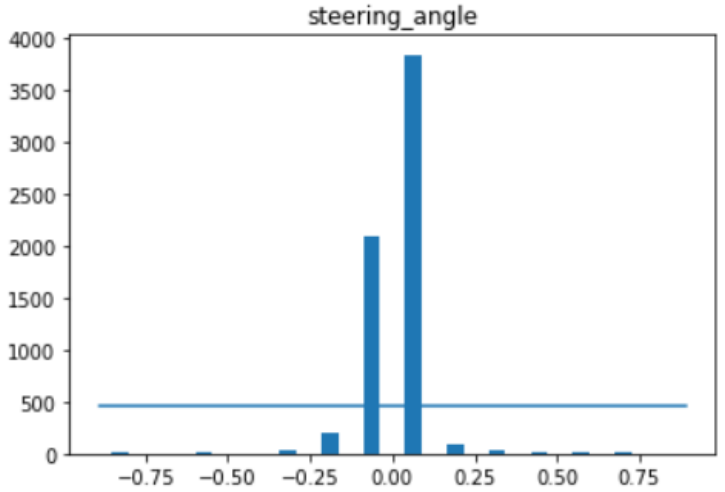
Car State

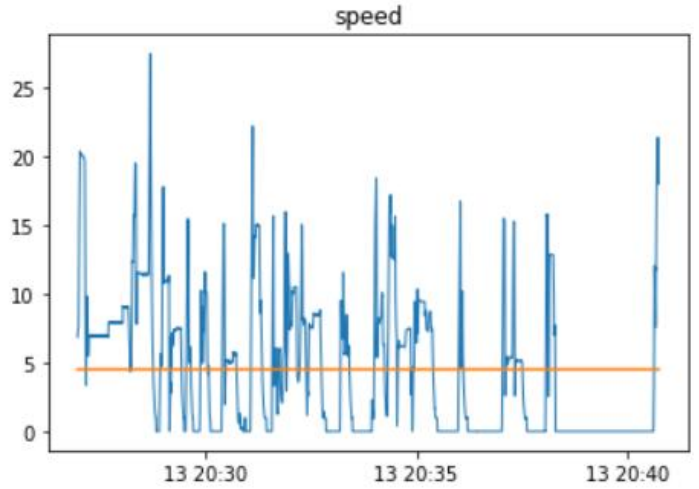
- Speed
- Steering Angle
- Throttle & Brake Power

Trip

GTA

- **Trips** end to end travelling from point A to point B. Typically 10 minutes of travel, recorded at 7 fps.
  - **Various driving conditions**, like day/night, rain or sunshine and time of day
  - **Drivers and cars**, various drivers including Franklin, Michael and Trevor (If he is sober) was used..
  - **Segments** Each trip gets broken down into 1 min segments to simplify training
    - **Video** Each segment has frames (800x600 RGB)
    - **Control** Each frame has a correlated car state saved, including the steering angle, power applied to the brake and throttle.





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Demo

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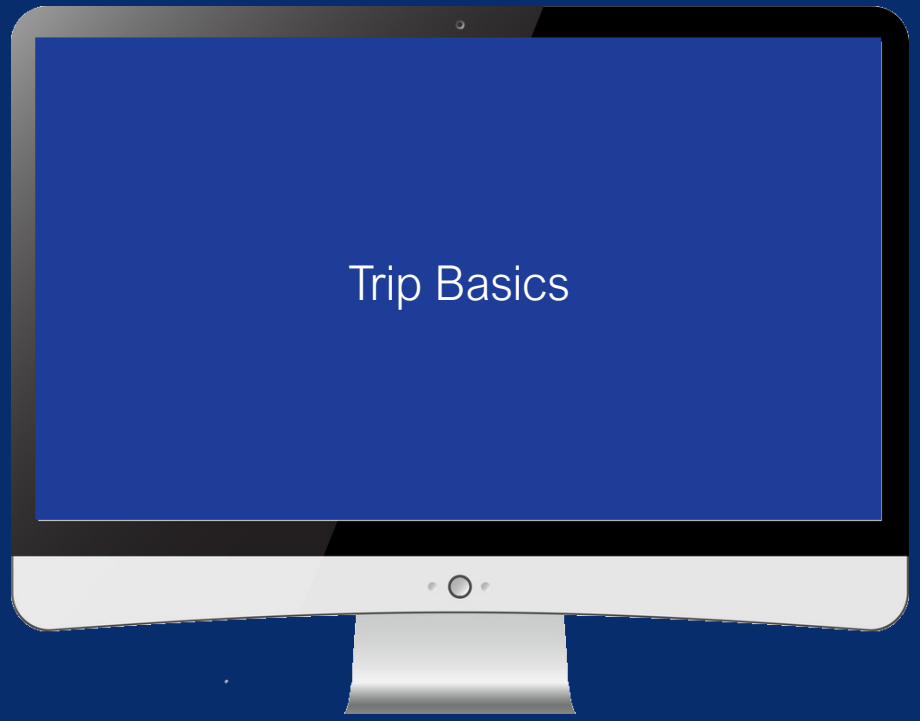

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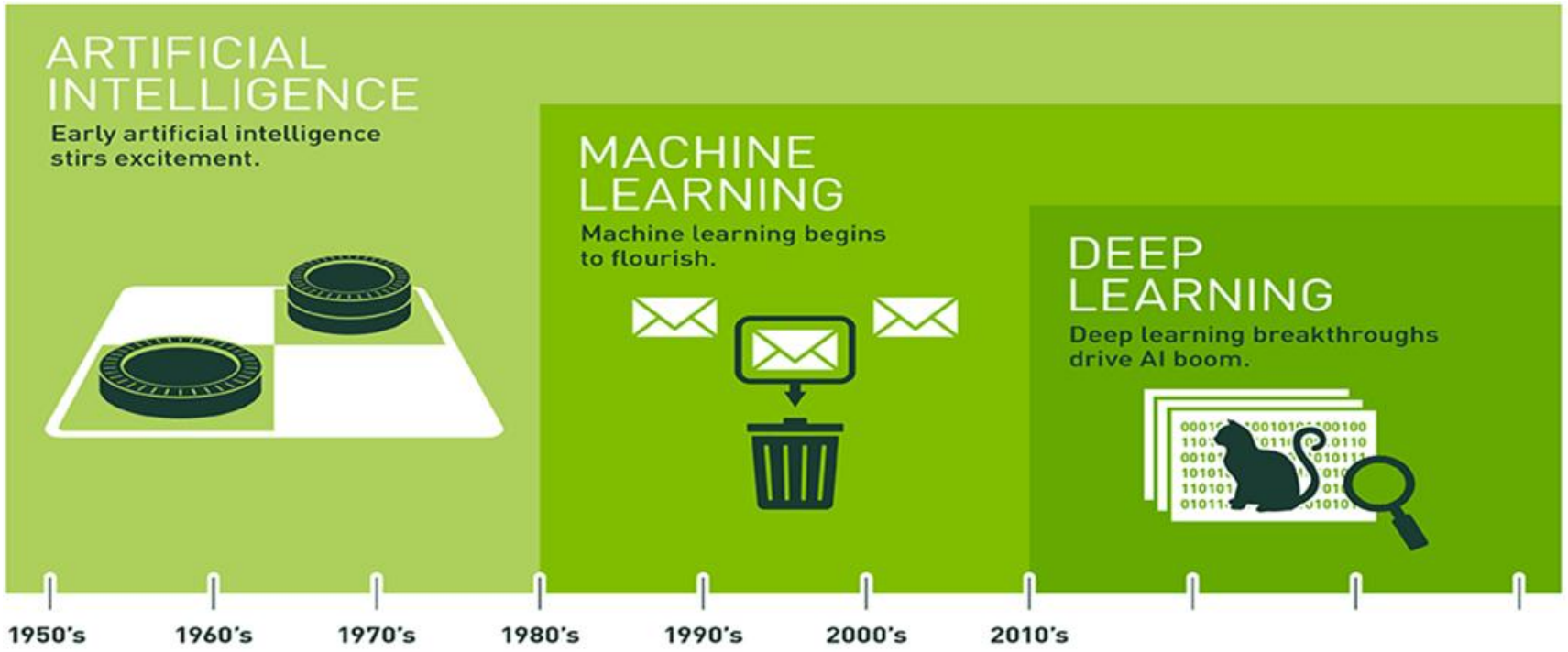
Deep learning



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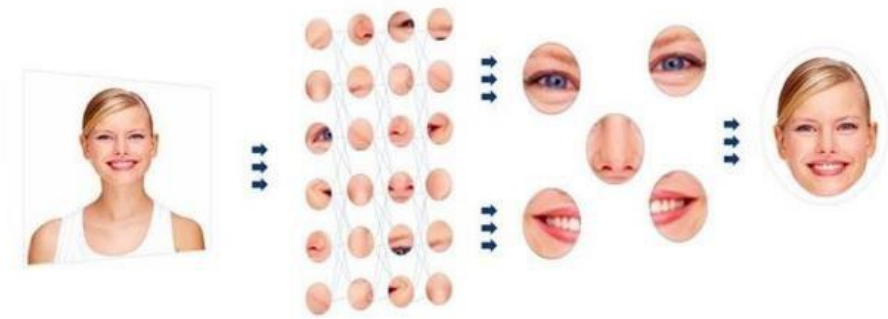
Deep learning

- **Techniques**
  - Transfer learning
  - Regression



- **Imagenet Large Scale Visual Recognition Challenge (ILSVRC)**
  - ResNet
  - AlexNet

- **Frameworks,** to offload learning to GPU

PyTorch

TensorFlow

Demo

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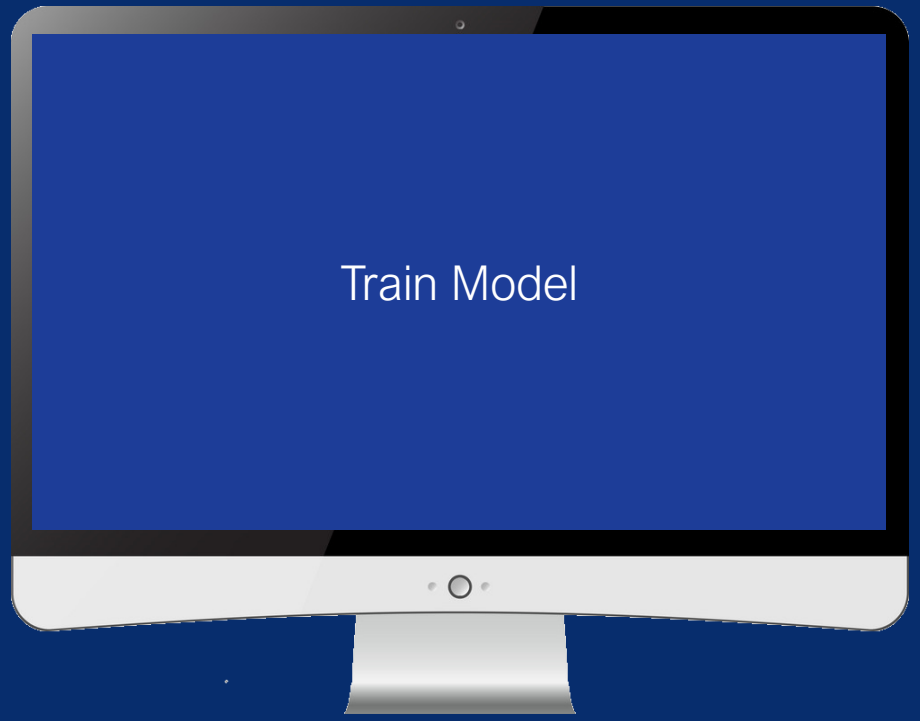

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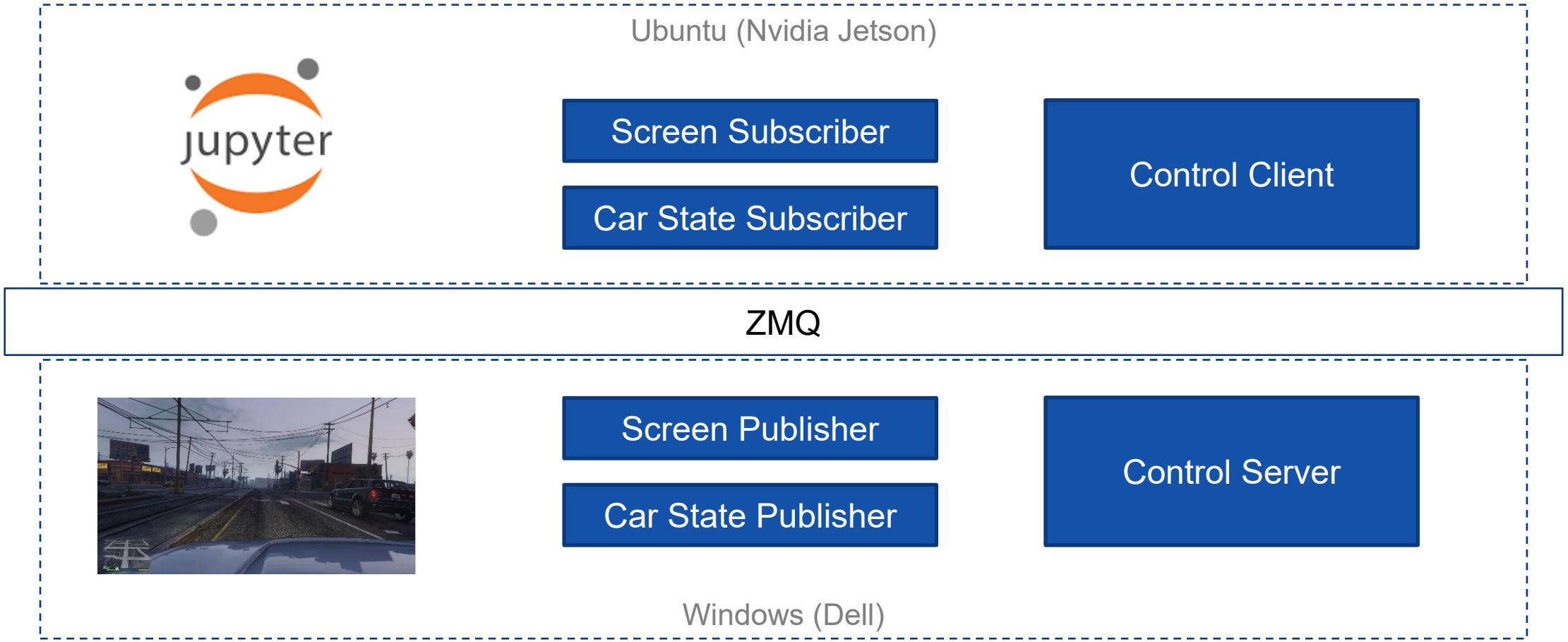
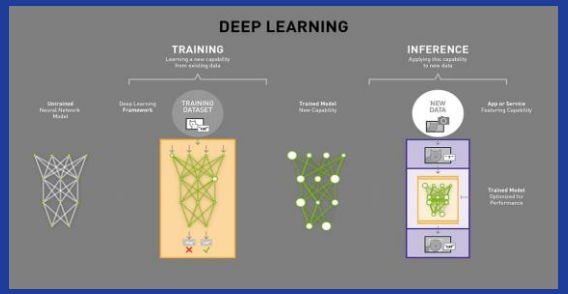
Architecture



The Plan

COLLECT
training data

TRAIN
our model



EVALUATE
our model

Lightstone

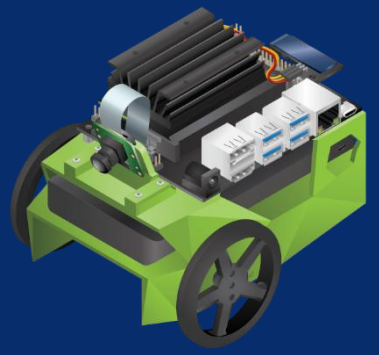
Before we start

- **Disclaimers**, I am not a…
  - Python developer
  - AI expert
  - Gamer

- All code and examples will be available to download
- Almost all the examples are Jupyter notebooks

Before we start

- Setup
  - Dell Latitude
  - Jetson Nano
- Based on JetBot
  - Road following
  - Object detection
  - Collision avoidance
- Architecture
  - Distributed (ZMQ)
  - Over-engineered (sorry)



Summary

- **Machines** can **learn** what **humans** can **do**
- **Simple pattern**

- **Many other applications like**
  - Fruit sorting and picking
  - Security systems