MICHIGAN STATE
U N I V E R S I T Y

Project Plan

Classifying Target Vehicles for Adaptive Cruise Control

The Capstone Experience

Team Bosch

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From Students…
    …to Professionals

Functional Specifications

- Currently Bosch employs people to manually label video data. This is a tedious and time-consuming process.

- Our goal is to develop a tool which automatically creates labels using machine learning.

- Process recorded video data to perform vehicle and lane recognition

- Automatically label target objects
  - "Target Object Present"
  - "Host Vehicle Changing Lanes"
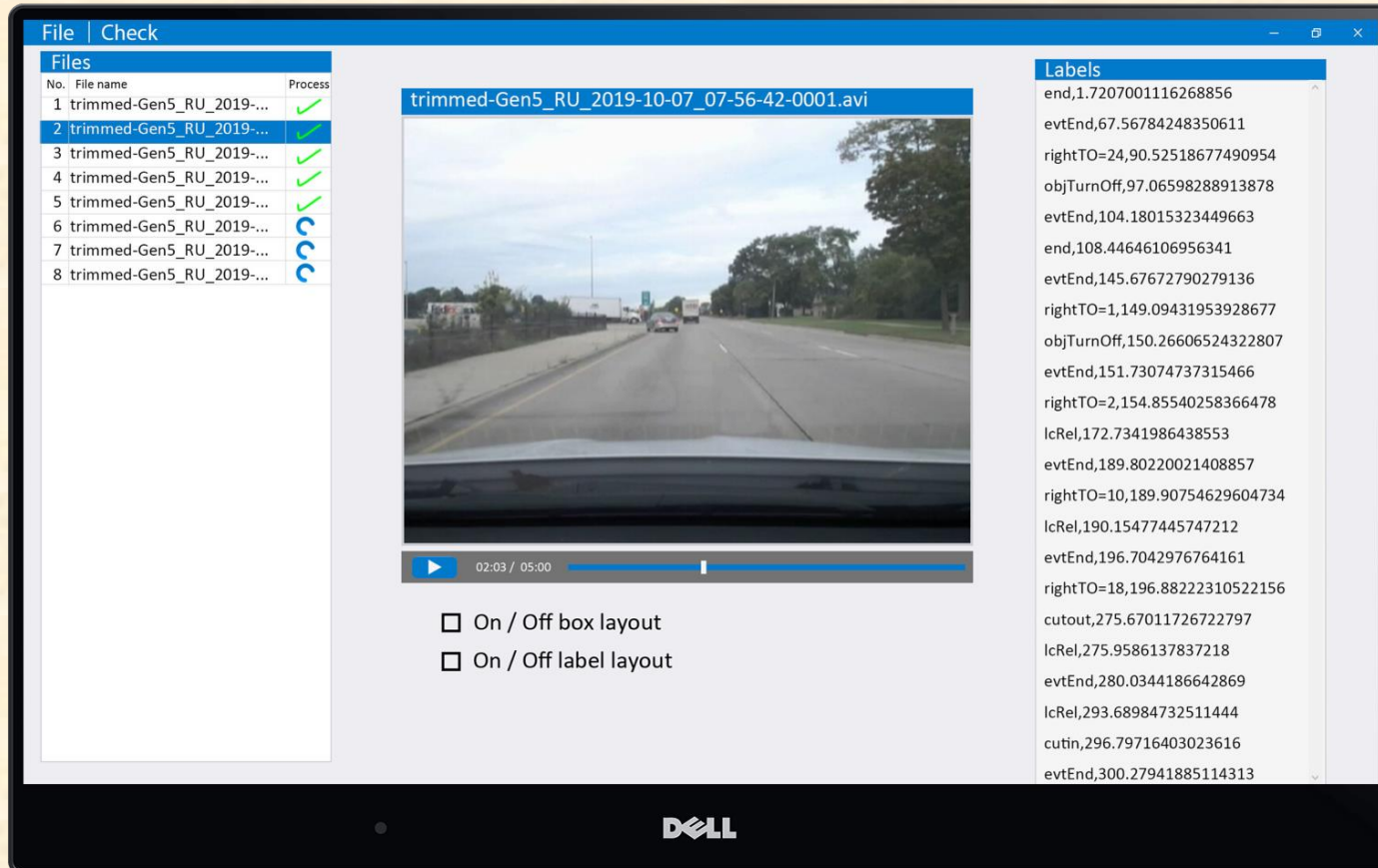 - "Target Object Cutting into Host Lane"

- Output a label file with 80% - 90% labeling accuracy

Design Specifications

- Desktop program

- Display box and Label Overlay on Video

- Display predicted Label Confidence Rating

- Creates a text file with labels and event timestamps

- Use Case: Save manual labor on dataset labeling
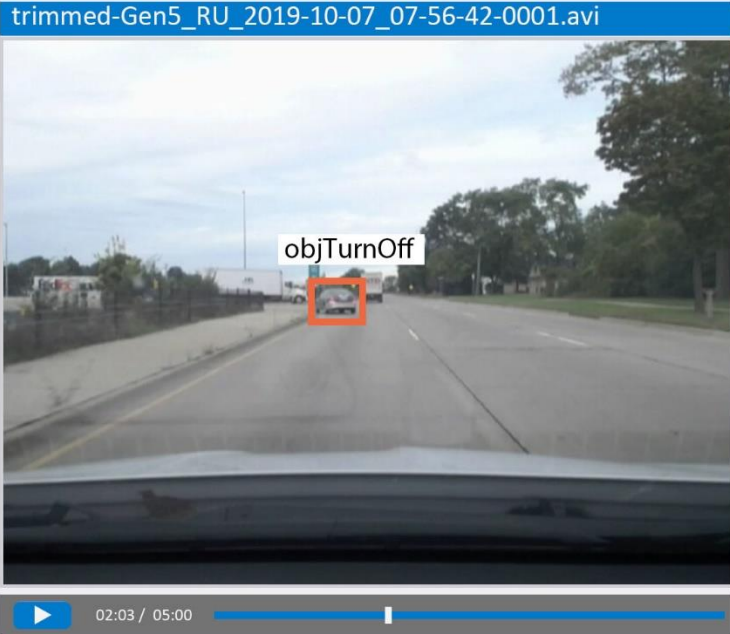
Screen Mockup: Main Screen

Screen Mockup: Overlays

Screen Mockup: Confidence Rating

No.	File name	Accuracy
1	trimmed-Gen5_RU_2019-10-07_07-56-42-0001_m0.avi	85%
2	trimmed-Gen5_RU_2019-10-07_07-56-42-0001_m1.avi	74%
3	trimmed-Gen5_RU_2019-10-07_08-14-23-0001_m0.avi	100&
4	trimmed-Gen5_RU_2019-10-07_08-14-23-0001_m1.avi	90%
5	trimmed-Gen5_RU_2019-10-07_08-14-23-0001_m2.avi	80%

Files

Labels
end.1.7207001116268856

evtEnd,300.27941885114313

Screen Mockup: Comparison View

Technical Specifications

- The program takes an AVI video file as input and processes it with a machine learning model

- Facebook's Detectron2 for vehicle detection and semantic segmentation

- Canny edge detection for lane line detection

- Outputs a text file with label predictions and timestamps to events of interest

- Ray for concurrent processing of videos off of the python GUI thread

System Architecture
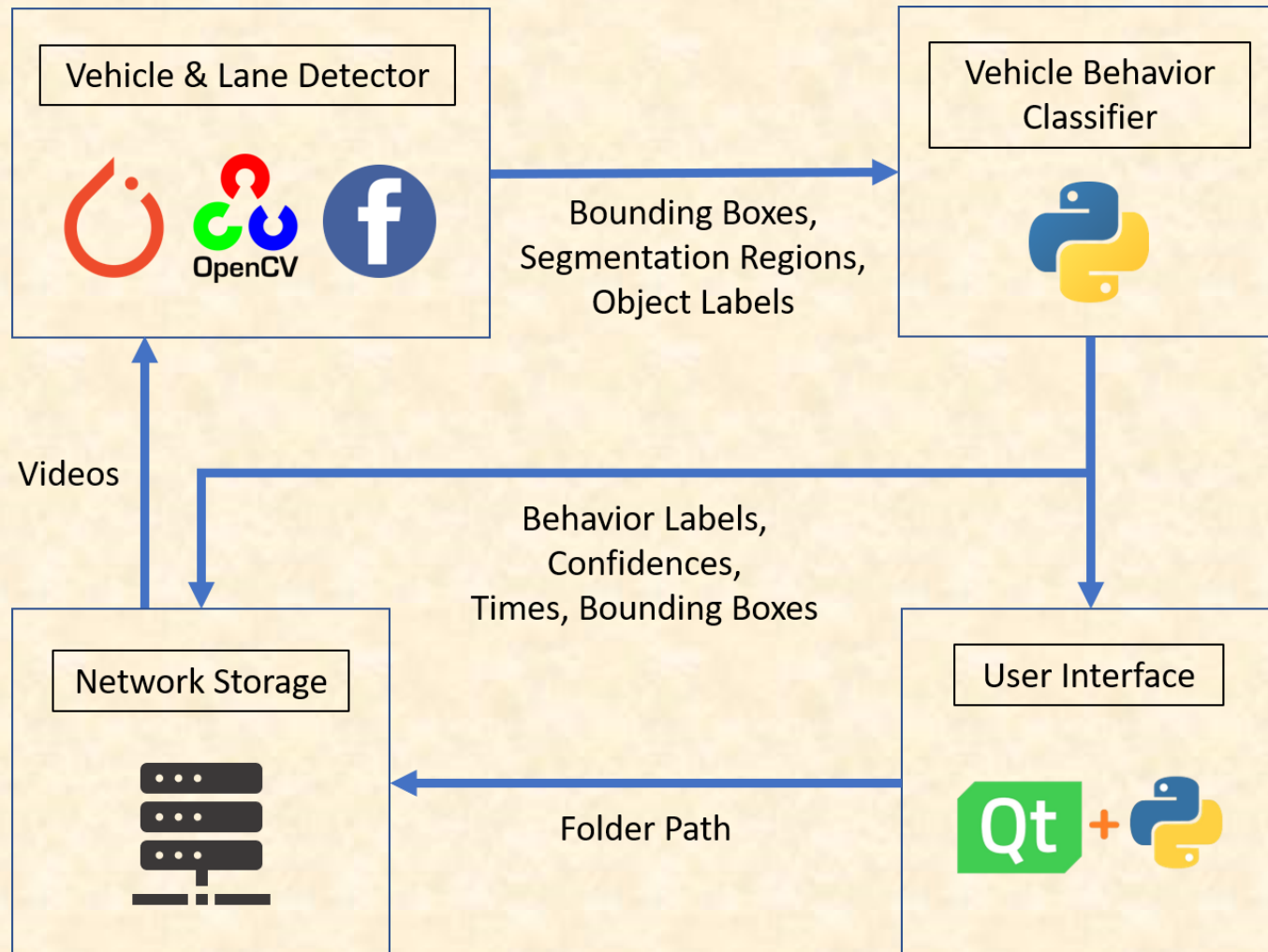
System Components

- Hardware Platforms
  - External Hard Drive containing video data
- Software Platforms / Technologies
  - Python
  - PyQT
  - OpenCV
  - Facebook's Detectron2
  - PyTorch
  - Ray

Risks

- Large Data
  - Managing the large amount of compressed data
  - Programmatically access compressed videos using a Python library
- Model Accuracy
  - Fine-tuning the feature extraction model
  - Consider cloud computing environment such as Google Cloud Platform
- Bad Data
  - Low quality data points in the dataset
  - Locate and remove those data points
- Algorithm Integration
  - Label generation and computer vision algorithms
  - Research box / line collision test and common computer vision algorithms