Drunk Driver Detection using Convolutional Neural Networks

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Background

- Traffic accidents are leading cause of death in the U.S. for people under the age of 54 (1)

- DUI's also take up ⅓ of all traffic-related deaths (2)

- Tools like the breathalyzer and blood tests can have high margins of error or are too intrusive (3)

Purpose

- To create an accurate & quick tool for intoxication detection
- Utilize face detection
- Deep Learning & Convolutional Neural Networks

Initial Data Collection

- Contacted researchers at IIT Ropar

- Initial dataset contained 2 folders
  - Drunk videos
  - Sober videos

- Cleaned and downloaded them to my computer

Initial Data Processing

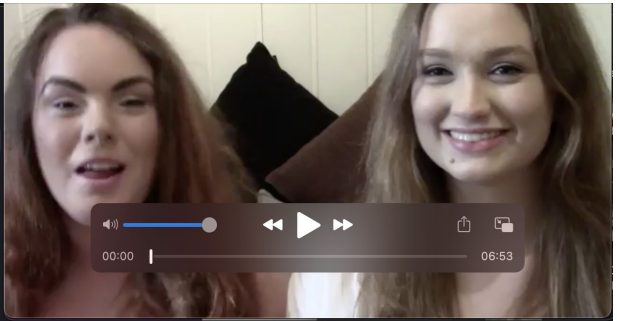
- 4 modules
  - Shot segmentation
  - Face detection
  - Face tracking
  - Face cropping

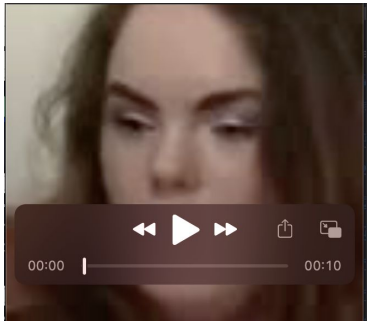
- Debugged modules and ran videos through modules

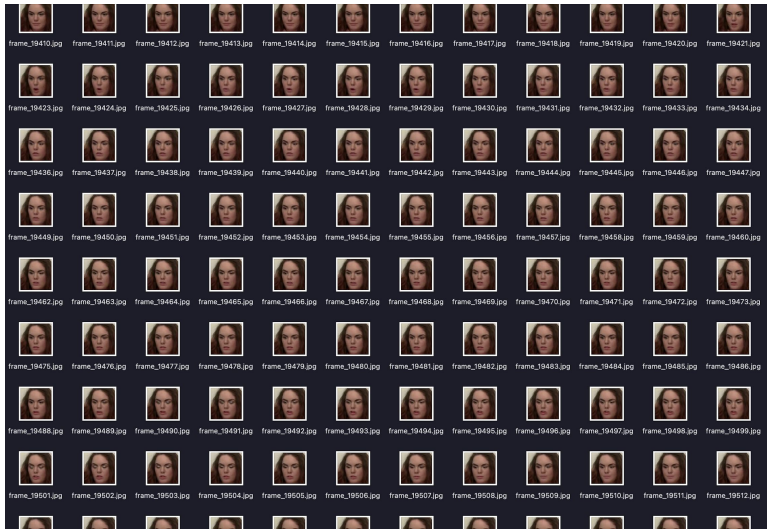
- Resulted in cropped videos focused on the face

Final Data Extraction

- Cleaned cropped videos
- Extracted every frame from videos







Data Preprocessing

- Prepped data
  - Randomizing
  - Resizing
  - Flattening
  - Splitting
  - Binarizing

- Baseline Dense Neural Network
  - Accuracy of approximately 50 %

Model Building

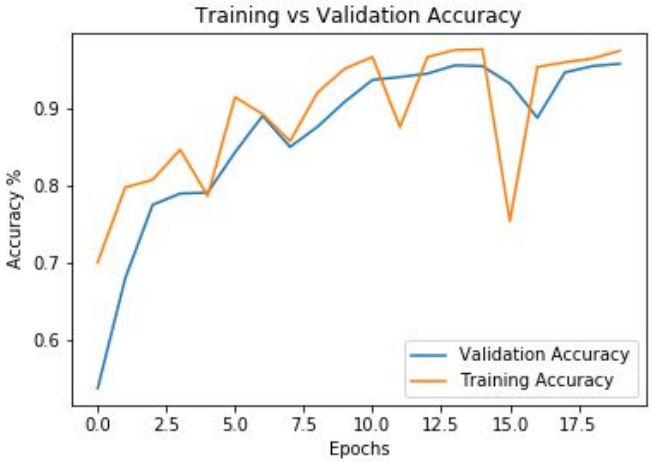
- Sequential architecture
  - 4 Convolution layers
  - 1 Flattening layer
  - 7 Dense layers

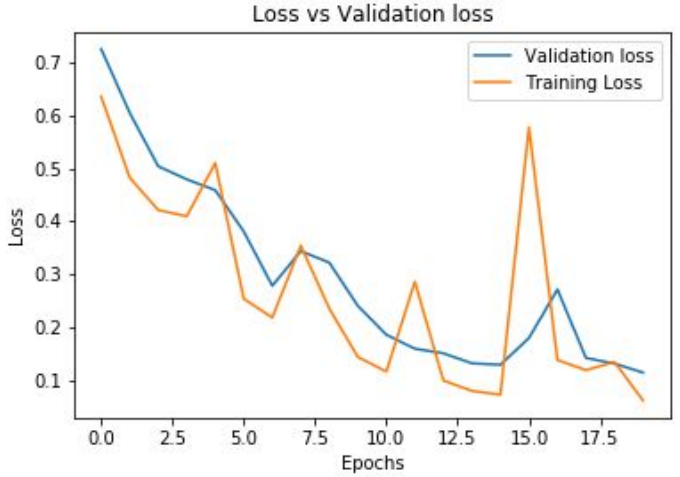
- Heavy debugging

```
# Convolution 1 / Input Layer
tf.keras.layers.Conv2D(128,(5,5),
input_shape=(128,128,3,),
activation='relu',padding="same",strides=(2,2)),
tf.keras.layers.MaxPool2D(2,2),
tf.keras.layers.Dropout(0.15),
# Convolution 2
tf.keras.layers.Conv2D(64,(3,3),activation='relu'),
tf.keras.layers.MaxPool2D(2,2),
tf.keras.layers.Dropout(0.1),
# Convolution 3
tf.keras.layers.Conv2D(32,(3,3),activation='relu'),
tf.keras.layers.MaxPool2D(2,2),
tf.keras.layers.Dropout(0.1),
# Convolution 4
tf.keras.layers.Conv2D(16,(2,2),activation='relu'),
tf.keras.layers.MaxPool2D(2,2),
tf.keras.layers.Dropout(0.1),
# Flattening Layer
tf.keras.layers.Flatten(),
# Dense 1
tf.keras.layers.Dense(2048,activation='relu'),
tf.keras.layers.Dropout(0.5),
# Dense 2
tf.keras.layers.Dense(1024,activation='relu'),
# Dense 3
tf.keras.layers.Dense(516,activation='relu'),
# Dense 4
tf.keras.layers.Dense(256,activation='relu'),
# Dense 5
tf.keras.layers.Dense(64,activation='relu'),
# Dense 6
tf.keras.layers.Dense(32,activation='relu'),
# Dense 7 /Output Layer
tf.keras.layers.Dense(1,activation='sigmoid')
```

Results

- ~95% Accuracy





Next Steps

- Consistent accuracy with increasing data
- Implement through a pipeline
- Results within minutes
- Problems with accuracy, errors, image quality

Conclusions

- More accurate than breathalyzers
- Less intrusive than blood tests
- Physical implementation within camera
- Enable a driver to start the car based on intoxication results
- Prevent possible collisions from drunk drivers

References

1. https://www.cdc.gov/injury/features/global-road-safety/index.html

2. https://www.cdc.gov/transportationsafety/impaired_driving/impaired-drv_factsheet.html

3. http://www.proctorcars.com/how-do-alcohol-breathalyzers-work-and-how-accurate-are-they/

4. https://towardsdatascience.com/basics-of-the-classic-cnn-a3dce1225add

Researchers at Indian Institute of Technology Ropar

Mehta, V., Srinadhu Katta, S., Pratap Yadav, D., & Dhall, A. (2019). DIF: Dataset of perceived Intoxicated Faces for drunk person identification.