Distracted Drivers

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Dangers

The dangers of distracted driving.

3,142

- Number Of People Killed By Distracted Drivers in 2020

52%

- Cell-owning Teens Ages 16-17 Said They Have Talked On The Phone While Driving

3,000

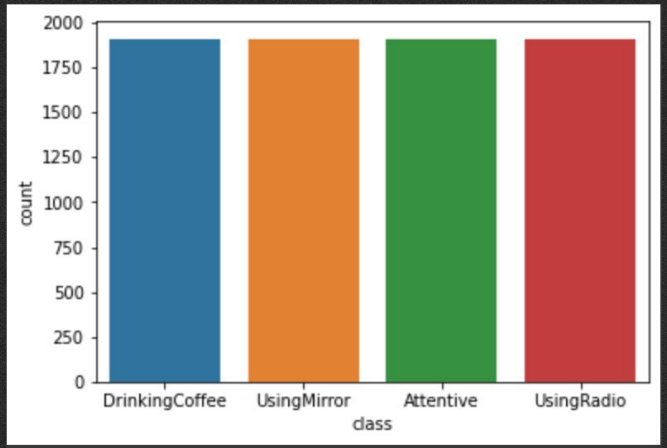
- Deaths Per Year Due To Distracted Driving. Distracted Driving Causes 280,000 Injuries Per Year

02

How can we fix this problem?

AI Classification

- Use of computer vision
  - Classify attentive/dangerous driving
- Model inputs - images
- Model outputs - classifications
- 4 classes
  - Drinking coffee
  - Using mirror
  - Attentive
  - Using radio
- Data set of 7,644 images
  - 1,911 images in each class
- Train an AI model to detect when driving is unsafe and alert driver

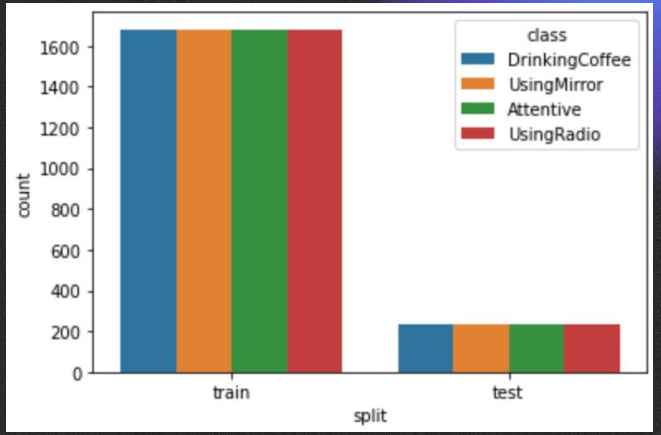


03

Models

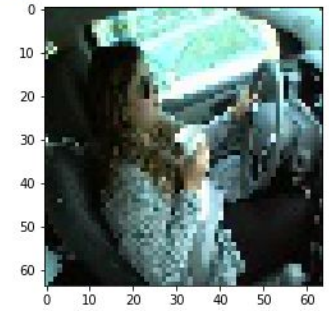
Preparing our Data

- Splitting data into training and testing
- Equal split among 4 classifications to ensure no bias is trained in model
- Visualizing dataset before use
    - Plotting one image
    - Using pixelated images so model can better recognize and classify data




```
[ ]  # plot a SINGLE image
     ### YOUR CODE HERE
     plot_one_image(image, labels=[image_label])
     ### END CODE
```

```
Label: [['DrinkingCoffee']]
```



Models

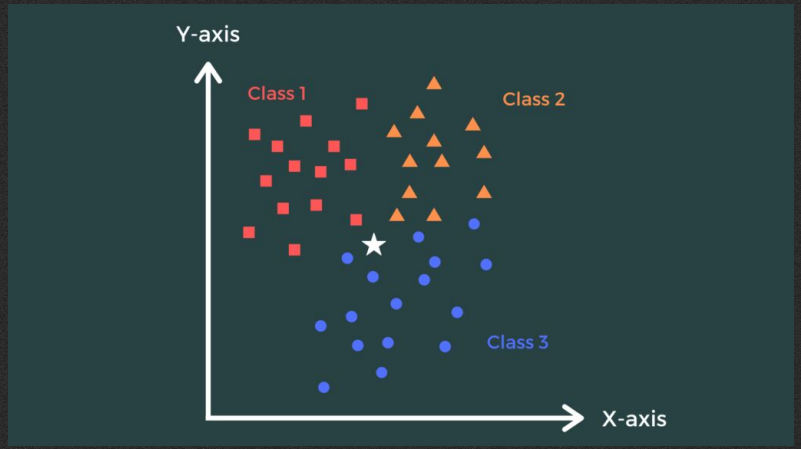
K-Nearest Neighbors

Decision Tree Classifier

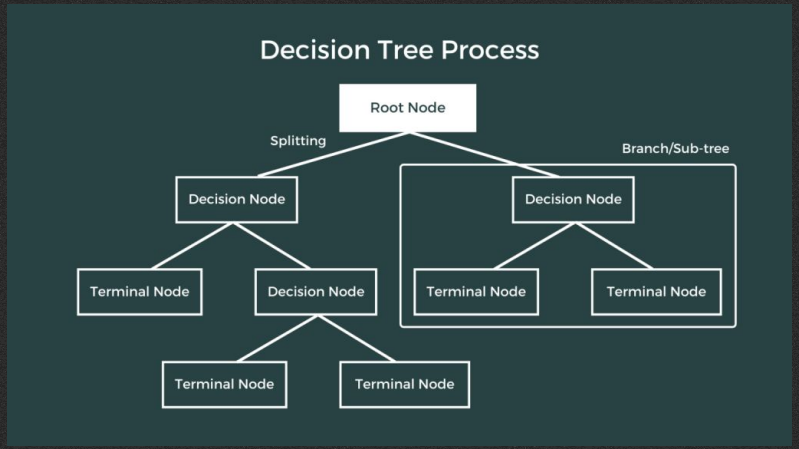
Neural Network

Convolutional Neural Network

KNN and Decision Tree Classifier



KNNs use proximity to make classifications or predictions about the grouping of an individual data point



Supervised machine learning algorithm that can be used for classification based on a past set of decisions made by the model

KNN and Decision Tree Classifier

K-Nearest Neighbors

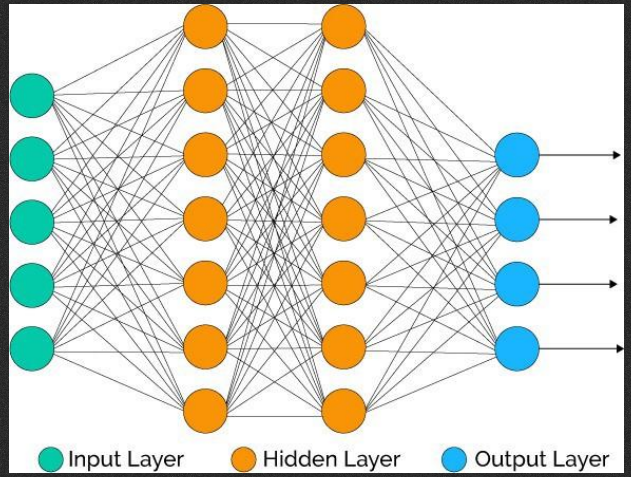
```
1 neighbors: 0.5510869565217391
2 neighbors: 0.5391304347826087
3 neighbors: 0.5206521739130435
4 neighbors: 0.5097826086956522
5 neighbors: 0.5173913043478261
6 neighbors: 0.5119565217391304
7 neighbors: 0.5065217391304347
8 neighbors: 0.4989130434782609
9 neighbors: 0.5010869565217392
```

Decision Tree Classifier

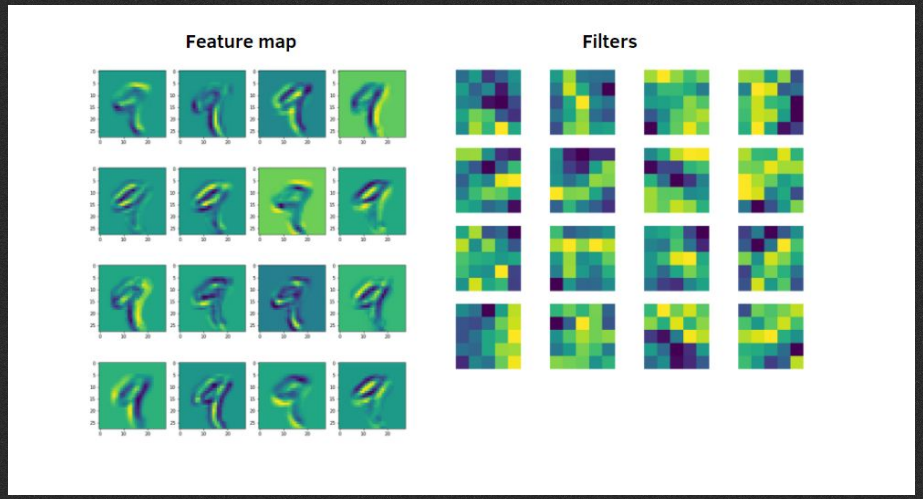
```
1 depth: 0.24239130434782608
2 depth: 0.2619565217391304
3 depth: 0.29456521739130437
4 depth: 0.2728260869565217
5 depth: 0.2467391304347826
6 depth: 0.2619565217391304
7 depth: 0.31956521739130433
8 depth: 0.24565217391304348
9 depth: 0.2391304347826087
```

Low-accuracy for both models - random chance of classification is 25%

Neural Network & Convolutional Neural Network

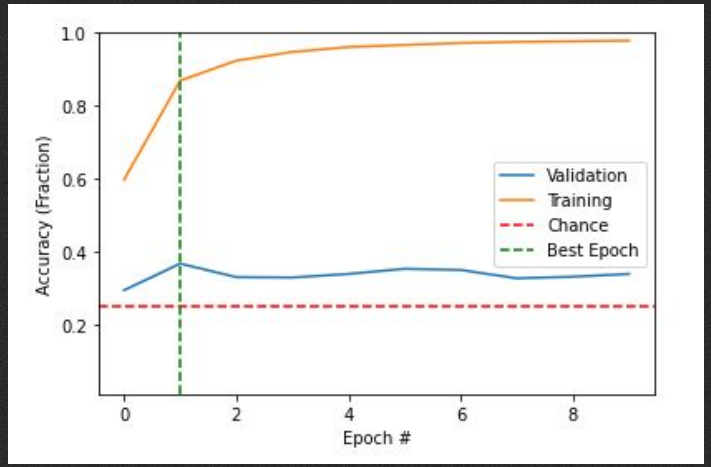


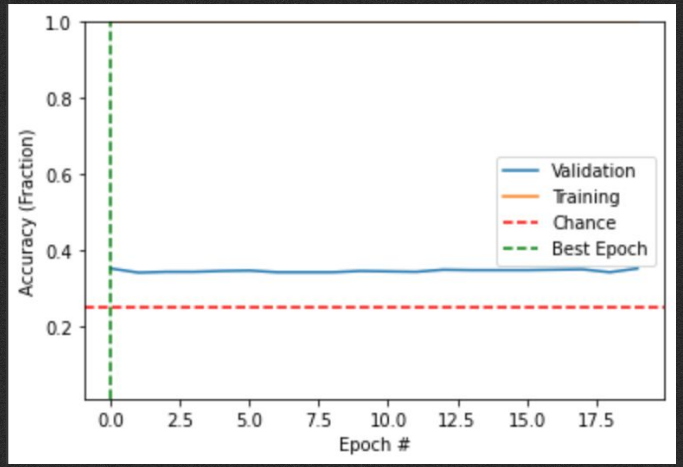
Neural Networks: Reflect the behavior of the human brain, allowing computer programs to recognize patterns and solve common problems in the fields of machine learning.



Convolutional Neural Network (CNN): A type of artificial neural network used in image recognition and processing that is specifically designed to process pixel data.

Neural Network & Convolutional Neural Network





~35% accuracy for both models even with high training accuracy - models are overfitting (memorizing training data instead of recognizing patterns and making generalizations about data)

04

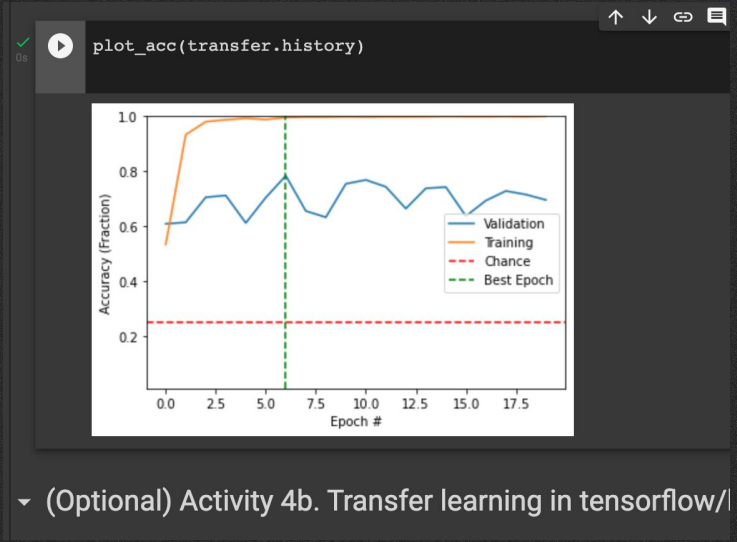
Solution

ImageNet - Transfer Learning

ImageNet is an image database for visual object detection that is able to distinguish 14 million images' categories.

VGG16 is a convolutional neural network (CNN) that has studied all 14 million images more than 74 times.

We used VGG16 to train our model to distinguish between attentive/distracted drivers.



Confusion Matrix

```
[ ]  final_labels = []
     for label in test_labels_strings:
       if label == 'Attentive':
         final_labels.append(0)
       else:
         final_labels.append(1)
     binary_predictions = []
     for label in predictions:
       ### FILL IN THIS LOOP ###
       if label == 0:
         binary_predictions.append(0)
       else:
         binary_predictions.append(1)

     print('Accuracy is %d %%'%(accuracy_score(final_labels, binary_predictions)*100.0))
```

The confusion matrix we created decided how accurate our classifier is. We transferred our 4 - way classification (Drinking coffee, Using mirror, Attentive, Using radio) to a 2- way classification (Binary: 1,0).

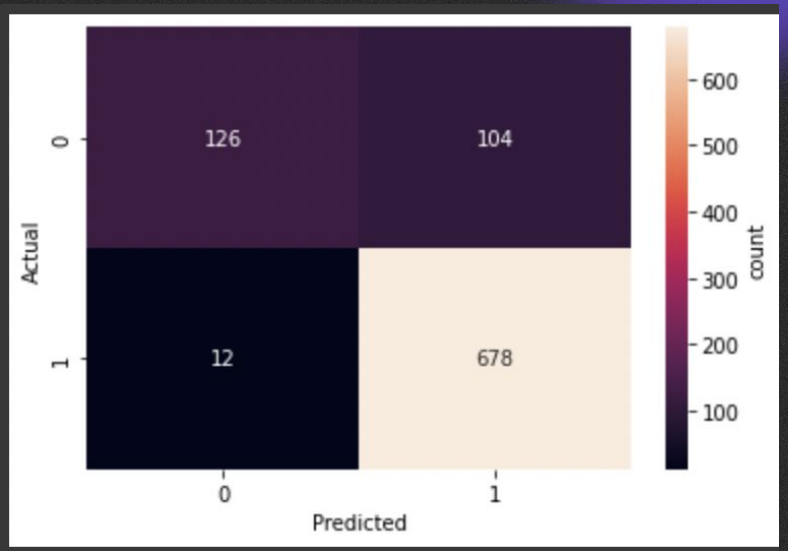
Testing our accuracy

```
confusion = confusion_matrix(final_labels, binary_predictions)
print(confusion)

tp  = confusion[1][1]
tn  = confusion[0][0]
fp = confusion[0][1]
fn = confusion[1][0]

print('True positive: %d'%tp)
print('True negative: %d'%tn)
print('False positive: %d'%fp)
print('False negative: %d'%fn)
```

We tested our accuracy by breaking it down into: True positive, True negative, False positive and False negative.



We then created a diagram to visualize our confusion matrix and be able to see the number of false positives, negatives and so on.

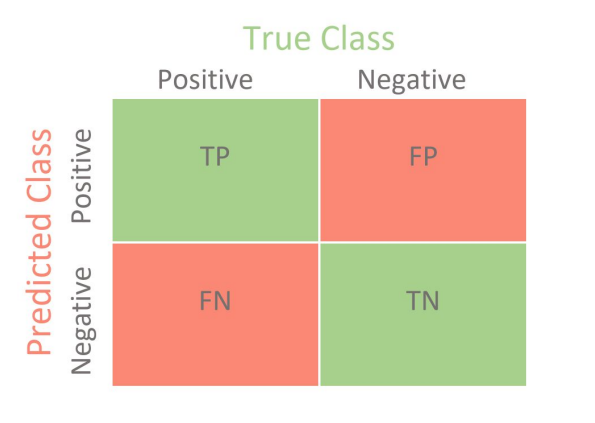
05

Implications and Ethics

Real World Impacts

Using AI to end distracted driving

False + vs -



Error

- Our model runs with 89% accuracy.
- What are the implications of this? How dangerous is a false positive or a false negative?

Privacy

- For our model to work, there must be a camera constantly recording the driver of the vehicle.

False Positives and Negatives

FALSE +

- Detected as distracted while attentive
- Not a large issue: at worst, a driver is incorrectly notified that they are distracted.

FALSE -

- Detected as attentive while distracted
- This type of error is more serious: a driver could lose their life because the system did not warn them to keep their eyes on the road.

Error and Privacy

Error in this implementation of AI is not extraordinarily dangerous

- Even false negatives, the most dangerous type of error in this case, are not extremely dangerous. Right now, many cars do not have this technology, and a false negative is the equivalent to driving a regular car.

Privacy may cause some issues

- Some people believe that being recorded in their car is an invasion of privacy. This is something that should be considered when using this technology. Does the additional safety it provides outweigh the consumer's right to privacy?

Thanks

Do you have any questions?

Write in the chat now!