Self-Driving Cars, Gehirnwagen

Road Sign Recognition

## presented by

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1. Background

Gehirnwagen is seeking to make self-driving vehicles and needs to be able to understand the street signs of Germany. A large dataset was provided of about 39,000 images of street signs. Ultimately a convolutional neural network was used to train and interpret road signs. Factors and considerations about the car seeing the signs at different angles, different lighting, or offset compared to the training data were taken into account.

1. Training Decisions

When deciding on the metrics for training the model two scores were used. An F1 score as well as an accuracy score were used. The accuracy score is used for intuitive evaluation and giving an overall performance snapshot but can be a bit misleading due to the imbalanced dataset. The dataset is imbalanced because the number of pictures for each type of sign varies greatly. Since the dataset isn't balanced using the F1 score is very appropriate and helps the model train even with the imbalance and still includes the minority cases.

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|  | Despite the accuracy score sitting in the low 90% range the F1 score is in the low 82% range. Indicating the model is struggling with minorities. |
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1. Data Augmentation

Since the car will end up seeing the street signs differently from the data, augmentation would help in real world performance greatly. The augmentations that were implemented were rotation of the images, translation, zoom, and contrast.

1. Residual Connections

An additional method to help improve the model’s ability to correctly identify the signs, residual connections were used. This process was able to bring the accuracy and F1 scores from being around 95% and 0.911 respectively to 100% accuracy and an F1 score of 1.

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| Before Residual Connections | After Residual Connections |
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1. Actionable Items

Since the pictures provided in the dataset are really about the same couple of signs but different frames from a recording of driving up to the signs, additional different pictures would help. Taking pictures or recordings on different days with different weather conditions and different lighting will reduce possible memorization and improve overall generalization.

Another concern with the dataset is that it does not include all the types of regulatory, parking, or speed limit signs. Additional data for these signs is a must for a safe self-driving vehicle to be used on the roadways in Germany.

1. Python Notebooks

Link to Google Colab notebook: [link](https://colab.research.google.com/drive/1UQUIG-Q9__fjN66WxjhkGk2BtEt5PkFX#scrollTo=qHFqeMTijCEA)