Model Card Version: 0.1_2022
License: Apache 2.0

German Traffic Sign Recognition

Model: https://github.com/dhivyasreedhar/Traffic-sign-detection-for-self-driving-cars/blob/main/traffic_sign_detection.ipynb
Documentation:
Model Card Authors: Dhivya S, dhivyasreedhar@gmail.com

The model analyzed in this card uses a **convolutional neural network** on the **German Traffic Sign Recognition Benchmark dataset** for traffic sign detection. In order to perceive traffic signs, a self-driving automobile must be able to recognize them. Recognizing traffic signs is a critical challenge for a self-driving system. Recognizing traffic signs can provide navigational and safety-related information. Self-driving cars need to be able to perceive traffic signals at intersections and crosswalks in order to follow traffic laws and avoid deadly accidents. Methods of deep learning have shown remarkable performance in the recognition of traffic.

Model Snapshot

Model Overview

MODEL ARCHITECTURE	INPUT(S)	OUTPUT(S)
Describe the architecture of the model here.	*Provide a description (with necessary specifications) of the input data provided to the model for outputs.*	*Provide a description (with necessary specifications) of the output data from the model for given inputs.*
Convolutional Neural Network	• **Width**: Width of the image • **Height**: Height of the image • **ROI.x1**: X-coordinate of top-left corner of traffic sign bounding box • **ROI.y1**: Y-coordinate of top-left corner of traffic sign bounding box • **ROI.x2**: X-coordinate of bottom-right corner of traffic sign bounding box • **ROI.y2**: Y-coordinate of bottom-right corner of traffic sign bounding box • **Path**: Path of the provided image	The output is the **ClassId** corresponding to the recognized traffic sign. **Eg:< 20>** The class of the traffic sign in the image is 20

	Eg: **<27,26,5,5,22,20,Train/20/00020_00000_00000.png>**	

Usage

APPLICATION	BENEFITS	KNOWN CAVEATS
Where has this model been used, or where is it currently used? Include links for readers to learn more.	*Why might users choose to use this model, relative to others? Evidence your response with metrics or performance results*	*Are there any known and preventable failures about this model?*
This model can be used to recognize traffic signs in self-driving cars. Driver assistance systems have to provide reliable results within natural, and therefore, complex and highly dynamic environments. At the same time mobile computers suffer from limited resources. These circumstances make the given tasks very demanding.	The model can be used in technologies for driver assistance systems, which represent an important and challenging field of application. These intelligent systems analyze the vehicle´s environment via different types of sensors, for instance video and radar, thus, increasing safety and comfort for the driver. The model performs with an accuracy of **95%**.Can also be used for research applications in computer vision.	The model cannot predict any other class of traffic sign other the trained 43 classes.

Model Creators

MODEL CONTACT	MODEL AUTHOR(S)	CITATION
How can model owners be contacted for questions about the model?	*Write the names of all authors associated with the model. Provide the affiliation and year if different from publishing institutions or multiple affiliations, using the format Name, Title, Affiliation, YYYY:*	*If available, provide a citation to your model; else indicate unavailable.*
dhivyasreedhar@gmail.com.	Dhivya S, Department of Computer Science Engineering, Easwari Engineering College, Chennai, India, 2022	Unavailable.

System Type

SYSTEM DESCRIPTION	UPSTREAM DEPENDENCIES	DOWNSTREAM DEPENDENCIES
Is this a standalone model, or intended to be used as part of a system with other models? Include links where necessary.	*If the model requires specific inputs, where should they come from? Are there any specific preprocessing steps that should be applied? Include links where necessary.*	*If the model's outputs can be fed into another system, where should they go? Are there any specific post-processing steps that should be applied? Include links where necessary.*
The German Traffic sign detection model can be used as a standalone model.	The value for Width, Height, ROI.x1, ROI.y1, ROI.x2, ROI.y2 should be numeric. The Path value should be string.	The ClassId can be matched with the sign name and displayed.

Implementation Frameworks

HARDWARE & SOFTWARE FOR TRAINING	HARDWARE & SOFTWARE FOR DEPLOYMENT
Describe the hardware and software used for training the model.	*Describe the hardware and software used for deploying the model.*
• OS: windows, Mac etc. • Development tool: Google collab / Jupyter Notebooks • Language: Python 3.6 and above	• OS: windows, Mac etc. • Development tool: Google collab / Jupyter Notebooks • Language: Python 3.6 and above

Compute Requirements

COMPUTE REQUIREMENTS FOR FINE-TUNING*		COMPUTE REQUIREMENTS FOR INFERENCE*	
Describe the following compute requirements. Indicate unavailable if necessary. Do not delete any choices.		*Describe the following compute requirements. Indicate unavailable if necessary. Do not delete any choices.*	
Number of Chips	unavailable	Number of Chips	unavailable
Training Time (days)	unavailable	Training Time (days)	unavailable
Total Computation (floating pt operations)	unavailable	Total Computation (floating pt operations)	unavailable
Measured Performance (TFLOPS/s)	unavailable	Measured Performance (TFLOPS/s)	unavailable
Energy Consumption (MWh)	unavailable	Energy Consumption (MWh)	unavailable

*Modeled after Patterson, David, et al. "Carbon emissions and large neural network training." arXiv preprint arXiv:2104.10350 (2021).

Model Characteristics

MODEL INITIALIZATION

Describe how the model has been initialized. Include information about if the model trained from random initialization, or fine-tuned from a pre-trained model?

Write here. Link to additional details or include examples where available / necessary.

Training Epochs	15
Base Learning Rate	0.001
Method	LeNet
Loss	Categorical cross-entropy

MODEL STATUS

Is the model static, or retraining on online data? If this model is trained and retrained, please include the update cadence, and the release date for the latest version.

Write here. Link to additional details or include examples where available / necessary.

Dataset Name	German Traffic Sign Recognition Benchmark Dataset (GTSRB)
Version	0.1
Release Date	01.20.22
Update Cadence	never

MODEL STATS

What is the size of the model? Include attributes like number of weights and layers.

Write here. Link to additional details or include examples where available / necessary.

Size	823 KB
Weights	Not applicable
Layers	6
Latency	15 mins

PRUNING

Is your model pruned? If so, what is the level of sparsity of the deployed model?

No, the model is not pruned.

Methods	Not applicable

QUANTIZATION

Is your model quantized? If so, what is the bit representation of the deployed model?

No, the model is not quantized.

Methods	Not applicable

DIFFERENTIAL PRIVACY

If any, describe the techniques implemented to preserve privacy?

Not applicable

Structuring	Not applicable	**Pre-quantized Representation**	Not applicable
Sparsity Level	Not applicable	**End Bit Representation**	Not applicable
Number of Params at Sparsity	Not applicable	**Hardware**	Not applicable
Accuracy at Final Sparsity after Training	Not applicable		
Perplexity at Final Sparsity after Training	Not applicable		

Data Overview

TRAINING DATASET SNAPSHOT		DATASET MAINTENANCE & VERSIONS		INSTRUMENTATION	
Describe the dataset used to train the model. If a requested detail is inapplicable, following guidance on N/A. Include links to additional table(s) with more detailed breakdowns in the caption.		*Is the training data static, or updated/expanded? If so, what is the frequency with which this data is updated?*		*What instruments were used to collect or process the data? Describe any notable instrumentation requirements in the collection or preprocessing of data by customizing the table.*	
Write here. Link to additional details or include examples where available / necessary.		Write here. Link to additional details or include examples where available / necessary.		Write here. Link to additional details or include examples where available / necessary.	
Dataset Size	347.9MB	**Current Version**	1.0	**Instrumentation Criteria:** Data processing, annotation and image extraction was performed using the NISYS Advanced Development and Analysis Framework (ADAF), an easily extensible, module-based software system.	
Number of Instances	50000+	**Update Cadence for Online Data**	-	**Focal spot size**	-
Number of Fields	8	**Sampling methods**	Stratified Sampling	**Cooling method**	-

Labeled Classes	40+	**Validation methods**	-	**Avg Adult Effective Dose (mSv)**	-
Number of Labels	40+	**Processing methods**	-	**Operational voltage range**	-
Average labels per instance	3500	**Annotation methods**	Machine-generated Annotations		

DATA PRE-PROCESSING

Describe any augmentation methods used during pre-processing to attain the requisite format. Are there any criteria that data points must satisfy to be included in the training set?

The dataset is pre-processed, augmented and normalized.

DEMOGRAPHIC GROUPS

*Does the data contain any **labeled** groups**, or attributes that suggest demographic group membership? Describe any demographic groups considered when assessing distributions in the data.*

No

EVALUATION DATA

Describe any notable factors about your final test set, including your train/test/dev split, any notable differences between the collection protocols for training & test data.

Training set: 39.2k
Testing set: 12.6k.

Traffic sign recognition for autonomous vehicles

Training/Eval	95.5

***If there are groups that may be present, but are **not labeled** in the training data, please note this in the Ethical Considerations section below.*

Evaluation Results

Aggregate Evaluation Results

The training set gave an accuracy of about 95% and the testing set 86.7%.

EVALUATION PROCESS	EVALUATION RESULTS
Describe any notable factors in your process for evaluating your model's overall performance.	*Summarize and link to evaluation results for this analysis.*
Metrics: loss, train accuracy and valid accuracy **Evaluation Set: testing set of 12.6k samples**	We calculate the loss, train accuracy and valid accuracy for the CNN model. The training set gave an accuracy of about 95% and the testing set 86.7%.

Subgroup Evaluation Results

Document your disaggregated (e.g. fairness) evaluation. Duplicate this section (subgroup, evaluation process and data, evaluation results) for each subgroup evaluated.

SUBGROUP EVALUATED	EVALUATION PROCESS & DATA	EVALUATION RESULTS
Which subgroup was evaluated?	*Describe any notable factors in your process for disaggregated or sliced evaluation of model performance. Please include any assumptions made when disaggregating the data.*	*Are there any known and preventable failures about this model?*
testing set of 12.6k samples	No assumptions were made	testing set gave an accuracy of 86.7%.

Fairness Evaluation Results

FAIRNESS CRITERIA	FAIRNESS METRICS & BASELINE	FAIRNESS RESULTS
How did you define fairness? Describe the target fairness criteria you hoped to satisfy or optimize for before launch.	*Describe the metrics and the baseline for fairness against which you present your fairness results and how they are calculated.*	*Describe the results of your fairness analysis. Include any specific or points that you would want to highlight for readers.*
-	-.	-

Model Usage & Limitations

SENSITIVE USE	LIMITATIONS	ETHICAL CONSIDERATIONS & RISKS
Are there any use cases where deployment of this model would be considered sensitive?	*What factors might limit the performance of the model? What conditions must be satisfied to use the model?*	*What ethical factors did the model developers consider? Were any identified? What mitigations or remediates were undertaken? Whe possible, link to additional documents.*
Application:. Object detection, Computer vision, Machine learning, Deep learning **Pre-requisite training:** -	**Input conditions:** Traffic sign detection for signs should be from the listed 43 classes **Output Caveats:** none	**Research & Development:** Research applications in computer **Deployment:** -

Terms of Art

Concepts and Definitions referenced in this Model Card

Use this space to include the expansions and definitions of any acronyms, concepts, or terms of art used across the Model Card. Use standard definitions where possible (e.g. MLCC Glossary). Include the source of the definition where indicated. If you are using an interpretation, adaptation, or modification of the standard definition for the purposes of your Model or model, include your interpretation as well.

GTSRB

Definition: German Traffic Sign Recognition Benchmark

Source: https://benchmark.ini.rub.de/

Reflections on the Model

Use this space to include any additional information about the model that has not been captured by the Model Card.

offensive, insulting, threatening data	No, the modelcard does not contain any offensive, insulting, threatening data