FEV Signature Solutions
Traffic Sign Classification

FEV.io

Efficient training and deployment of your traffic sign recognition system

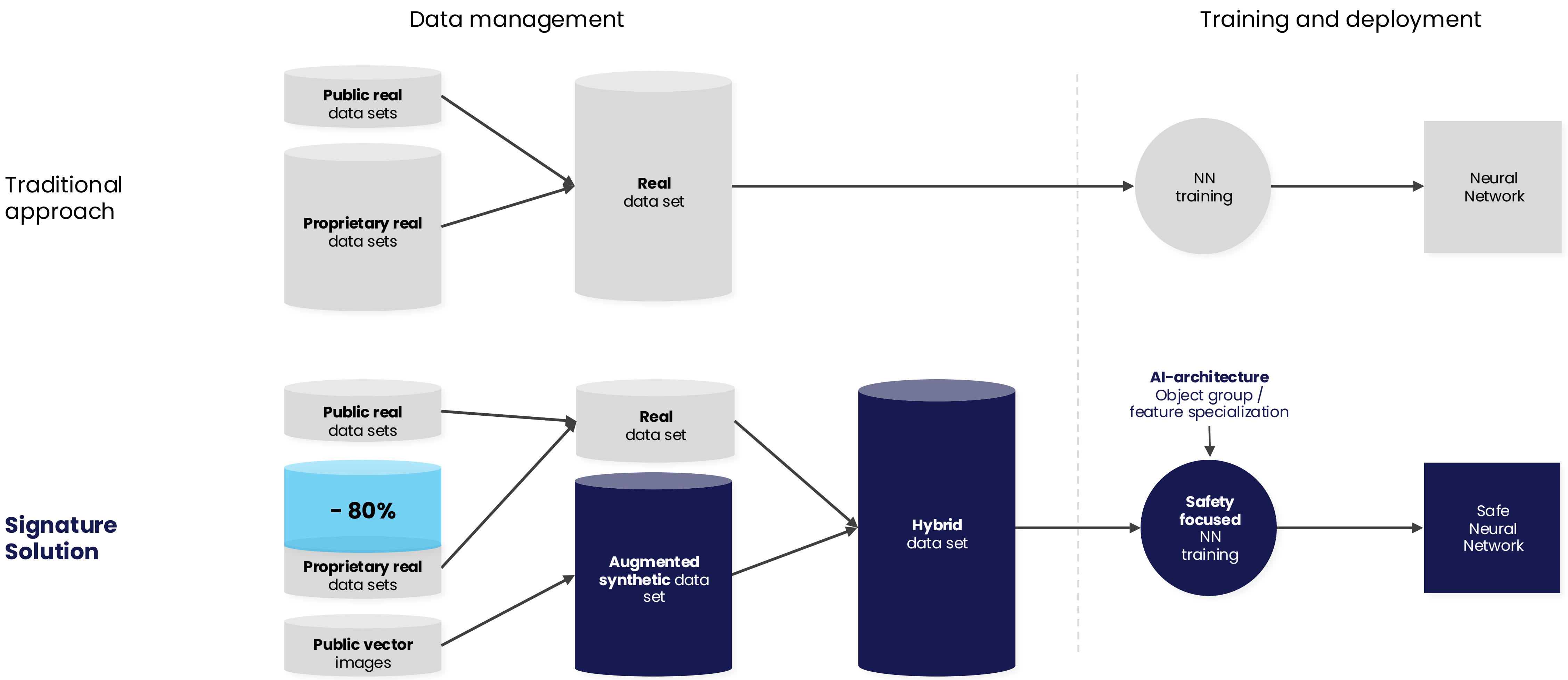
FEV offers

- AI-based traffic sign classification ensuring compliance with regulations (e.g. EU Regulation 2019/2144)
- Handling ODD- and country-specific variations for robust classification
- Advanced diagnostics to reduce AI deficiencies and misclassifications
- Synthetic training data with augmentation for enhanced input space coverage and accuracy
- Cost-effective and continuously updated AI models and datasets

Why FEV

- Custom-tailored solutions ensuring high adaptability and regulatory compliance
- Expertise in neural network training and assessment for safety-critical applications
- Seamless integration with existing autonomous systems
- Patent-applied AI classification and training methods

FEV's unique process for synthetic traffic sign recognition

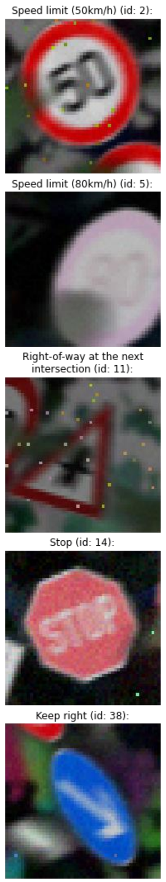


ODD: Operational Design Domain

Synthetic training data set of traffic signs

Real signs

Augmented signs



Your advantages

- 80% cost reduction
- Globally applicable
- Easily adaptable to ODD
- Always current

Patent application
AI TRAFFIC SIGN CLASSIFICATION WITH SYNTHETIC TRANING DATA
Enrico Astfalk
DE 10 2023 125 032.9

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→

Augmentation

Brightness
Contrast
Sharpness
Position
Orientation
Crop
Noise
Pixel fault
Distortion
Background
...

→


- We provide custom-tailored traffic sign images as neural network training data for your traffic sign classification task
- Our neural network training data sets are scalable and adaptable to all technical requirements and ODDs

Safety focused neural network training

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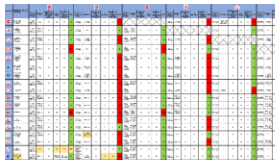
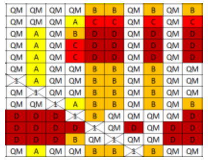
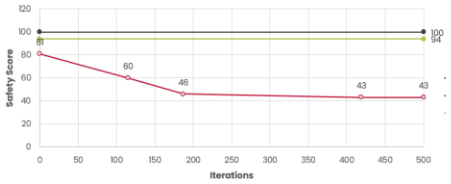
REDUCING SAFETY RELEVANT MISCLASSIFICATIONS OF NEURAL NETWORKS





ASIL	QM	A	B	C	D
Safety weights	1	4	8	16	32
Training weights	**3.6** x	**16.4** x	**1.0** x	**9.5** x	**28.0** x
No. of misclassifications	3	2	2	1	0
Safety score summands	3 +	8 +	16 +	16 +	0



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ACCURACY 99,9 %

SAFETY SCORE 43

01
Performing AI specific hazard and risk analysis and generating a risk matrix with application specific safety weights

02
Start training process optimizing the safety score which is based on the safety weights and the number of misclassifications

03
Variation of training weights sets and iteration of trainings to determine the parameters with the best safety score

04
Choosing the training weight set of the neural network with the best safety score and use the argumentation for the safety case

Patent application
SAFETY FOCUSED
NEUTRAL NETWORK
TRAINING
H. Böhme
A. R. Manchola
DE 10 2024 131 875.9

- Addresses how to specify safety requirements
- Safety Score KPI enables the quantification of safety in compliance with ISO/PAS 8800
- Derive specific safety requirements for the training of neural networks
- Reduction of safety-critical misclassifications
- Solution is flexibly adaptable to any AI classification task

Transparent and verifiable AI-architectures

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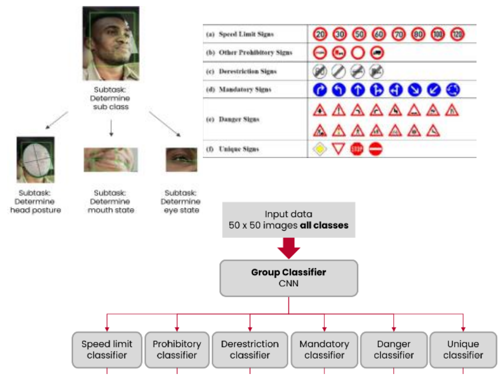
ENHANCING DECISION ACCURACY AND TRANSPARENCY WITH HIERARCHICAL CLASSIFICATION

Option A: Object group architecture

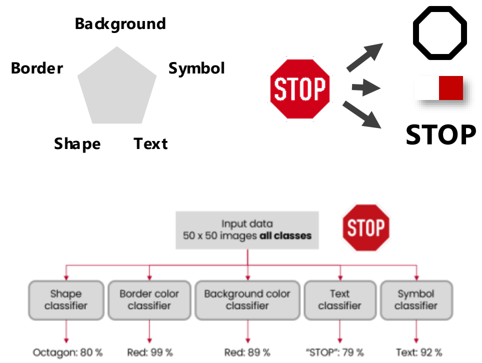


01 Divide classes in subgroups, with specialized sub-classifiers based on **visual similarities**

02 Add „rejection“ class, a confidence threshold and perform rule enhanced classification

03 Optimize the parameters of the neural networks towards the best safety score

Option B: Feature specialization architecture



01 Divide classes in subgroups, with specialized sub-classifiers based on **geometric features**

02 Each sub-classifier focuses on a single geometric feature

03 Optimize the parameters of the neural networks towards the best safety score

Patent application
PARALLEL AI TRAFFIC SIGN DETECTION BASED ON FEATURES
Amai Rivas Manchola
A. Weiß, E. Astfalk
DE 10 2024 004 064.1

- Focus on AI explainability and decision making
- Self-correcting behavior and enhanced system decision making
- Robust handling of uncertain inputs
- Solution is flexibly adaptable to any AI classification task
- Safety Score KPI enables the quantification of safety in compliance with ISO/PAS 8800

Our services and solutions for synthetic traffic sign classification

Consulting or engineering services

Data set

Data set creator

ASIL ready adaptive traffic sign classification software

Product Flexibility & Options	Offering multiple product configurations for traffic sign classification, ensuring solutions tailored to specific customer needs.
Secure Parameterization	Ensuring full customer protection over system parameterization, allowing control over classification behavior and adaptability.
Expert Safety Support	Providing guidance and validation from experienced safety experts to enhance AI-driven classification reliability.
Seamless System Integration	Designed for smooth integration with other FEV solutions, enabling a unified and efficient AI-driven traffic sign recognition system.
Scalability & Adaptability	Ensuring AI models generalize effectively across diverse road environments and regulatory frameworks.

Get in touch with us for further information

www.fev.com/en/signature-solutions