

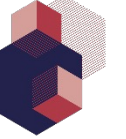
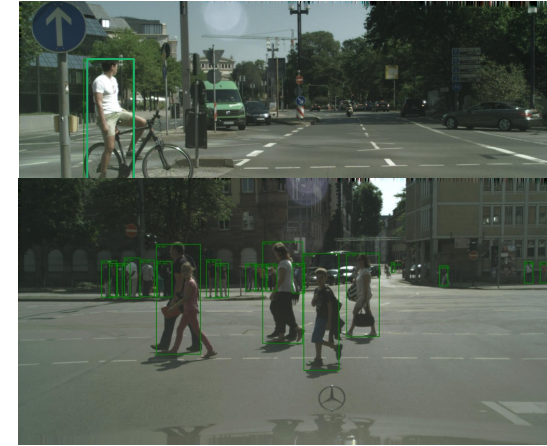


KI Wissen Final Event | 21-22 March 2024

Demonstration of the Interactive Visual Analytics System

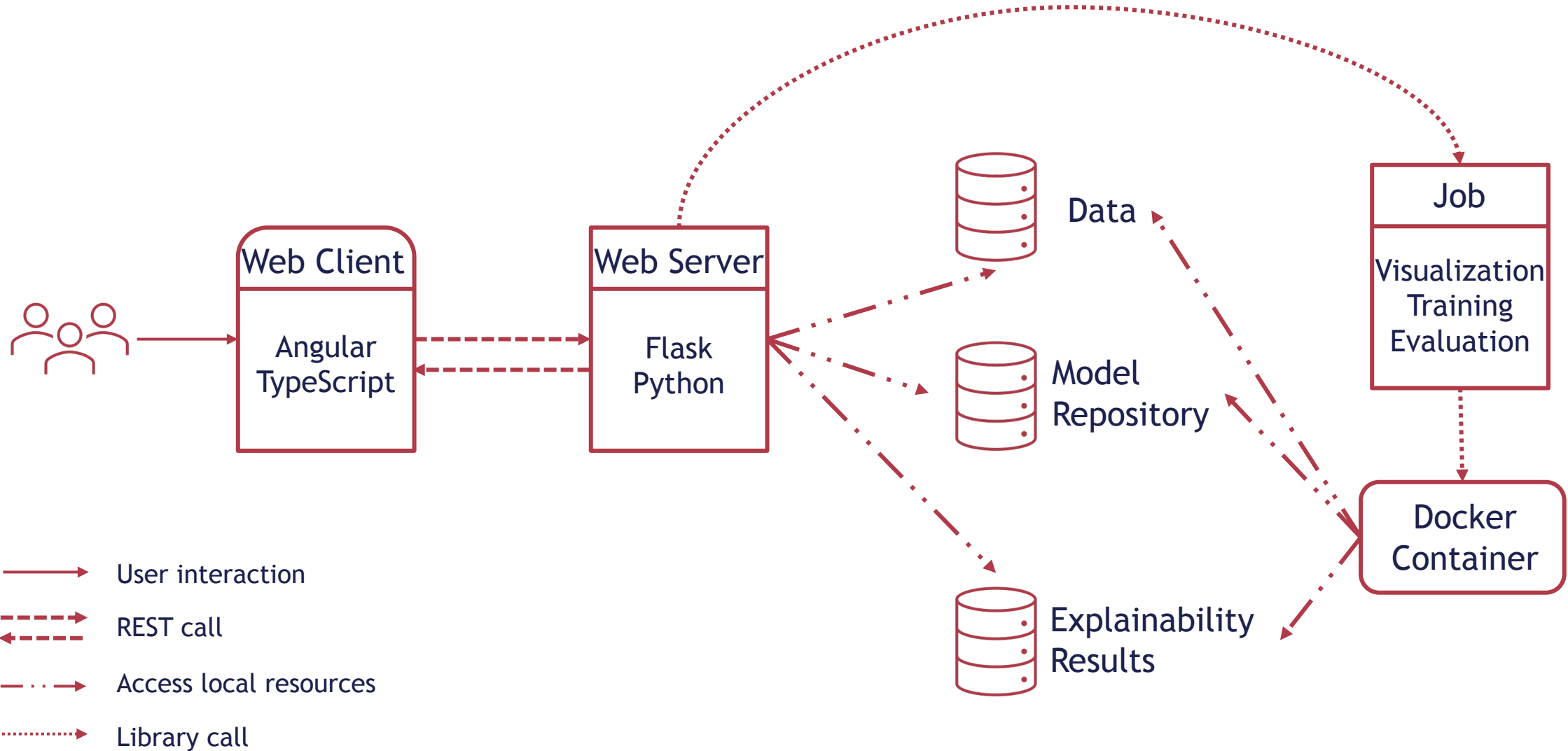
Kostadin Cvejovski | Fraunhofer IAIS

Motivation

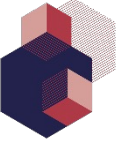


- Collect all pedestrian detection models into one tool
- Collect all explainability methods into one tool
- Tool that allows interactive interaction of the user
- Easier debugging of model development and training
- Pre-computed and real-time explainability analysis

Software Architecture



Main Menu



Main Menu navigation options:

- Jobs: Manage Analysis Jobs
- Results: Explore Analysis Results** (highlighted with a red box)
- Rules
- Autonomous Driving Decisions

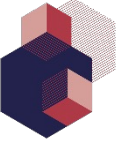
SELECT A GPU DEVICE 0

Filter

Name	LAMR (IoU 50%)	LAMR (IoU 75%)
f2dNet_citypersons_evaluated_citypersons_validate	0.197	0.211
faster_rcnn_conti	0.5	0.5
frcnn_citypersons_no_aug_evaluated_citypersons_validate	0.214	0.302
Malala	0.007	0.008

Items per page: 5 | 1 - 4 of 4

Main Page



← Menu Current Model: FRCNN_CITYPERSONS_NO_AUG_EVALUATED_CITYPERSONS_VALIDATE

CONFIDENCE THRESHOLD: 80% ● TARGETS ○ DETECTIONS

Prediction Type: ALL

Object Class: PEDESTRIAN

Augmentation: AUGMIX

Filter

#	Image Name	# of Targets	# of Detections	# of False Negatives
337	munster_000010_000019_leftimg8bit	8	7	6
189	frankfurt_000001_054884_leftimg8bit	10	9	4
154	frankfurt_000001_042384_leftimg8bit	5	4	3
308	lindau_000040_000019_leftimg8bit	0	0	0
119	frankfurt_000001_027325_leftimg8bit	3	4	0

Items per page: 5 | 1 - 5 of 487

Aggregate Metrics: IoU 50%

Category	MR	FN	FP	FPPI
reasonable	17.25%	293	1149	2.36
small	38.75%	155	406	0.83
occlusion	40.54%	298	2118	4.35
all	33.27%	1030	1066	2.19

Aggregate Metrics: IoU 75%

Category	MR	FN	FP	FPPI
reasonable	28.84%	490	1346	2.76
small	49.75%	199	450	0.92
occlusion	63.81%	469	2289	4.70
all	47.45%	1469	1505	3.09

Image Metrics: IoU 75%

Category	FN	FP
reasonable	1	4
small	1	0
occlusion	2	6
all	4	5

Statistics | Activations | Grad-CAM | Layer-wise Relevance Propagation (LRP) - Conti | SHAP - IAIS | Network Dissection - IAIS | TCAV - Conti/DFKI | RISE >

Navigation and Statistics



← Menu Current Model: FRCNN_CITYPERSONS_NO_AUG_EVALUATED_CITYPERSONS_VALIDATE

CONFIDENCE THRESHOLD 99% TARGETS DETECTIONS

Prediction Type: ALL

Object Class: PEDESTRIAN

Augmentation: AUGMIX

Filter

#	Image Name	# of Targets ↓	# of Detections	# of False Negatives
100	frankfurt_000001_017101_leftimg8bit	53	8	39
200	frankfurt_000001_057954_leftimg8bit	45	15	28
142	frankfurt_000001_038245_leftimg8bit	42	3	33
90	frankfurt_000001_014221_leftimg8bit	40	1	31
199	frankfurt_000001_057478_leftimg8bit	39	15	21

Items per page: 5 1 - 5 of 487

Original Selected for Visualizations

Statistics

Aggregate Metrics: IoU 50%

Category	MR	FN	FP	FPPI
reasonable	52.85%	898	124	0.25
small	80.00%	320	26	0.05
occlusion	81.36%	598	788	1.62
all	70.96%	2197	40	0.08

Aggregate Metrics: IoU 75%

Category	MR	FN	FP	FPPI
reasonable	55.68%	946	172	0.35
small	82.00%	328	34	0.07
occlusion	88.44%	650	840	1.72
all	72.87%	2256	99	0.20

Image Metrics: IoU 75%

Category	FN	FP
reasonable	9	1
small	1	0
occlusion	12	3
all	33	1

Activations

Grad-CAM

Layer-wise Relevance Propagation (LRP) - Conti

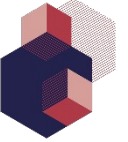
SHAP - IAIS

Network Dissection - IAIS

TCAV - Conti/DFKI

RISE

Network Activations



CONFIDENCE THRESHOLD 99%

TARGETS DETECTIONS

Prediction Type: ALL

Object Class: PEDESTRIAN

Augmentation: CUTMIX

Filter

#	Image Name	# of Targets	# of Detections ↓	# of False Negatives
200	frankfurt_000001_057954_leftimg8bit	45	15	28
199	frankfurt_000001_057478_leftimg8bit	39	15	21
473	munster_000146_000019_leftimg8bit	27	13	12
198	frankfurt_000001_057181_leftimg8bit	29	13	15
474	munster_000147_000019_leftimg8bit	20	13	6

Items per page: 5 | 1 - 5 of 487

Original

Statistics Activations Grad-CAM Layer-wise Relevance Propagation (LRP) - Conti SHAP - IAIS Network Dissection - IAIS TCAV - Conti/DFKI RISE

Aggregate Metrics: IoU 50%

Category	MR	FN	FP	FPPI
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occlusion	88.44%	650	840	1.72
all	72.87%	2256	99	0.20

Image Metrics: IoU 75%

Category	FN	FP
reasonable	2	2
small	2	2
occlusion	2	12
all	12	1

Grad-CAM



CONFIDENCE THRESHOLD 90%

TARGETS DETECTIONS

Prediction Type ALL

Object Class PEDESTRIAN

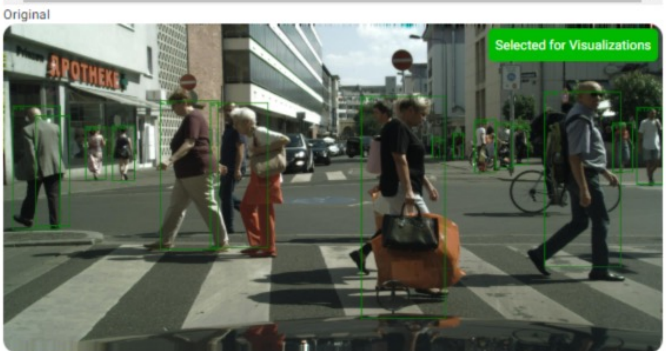
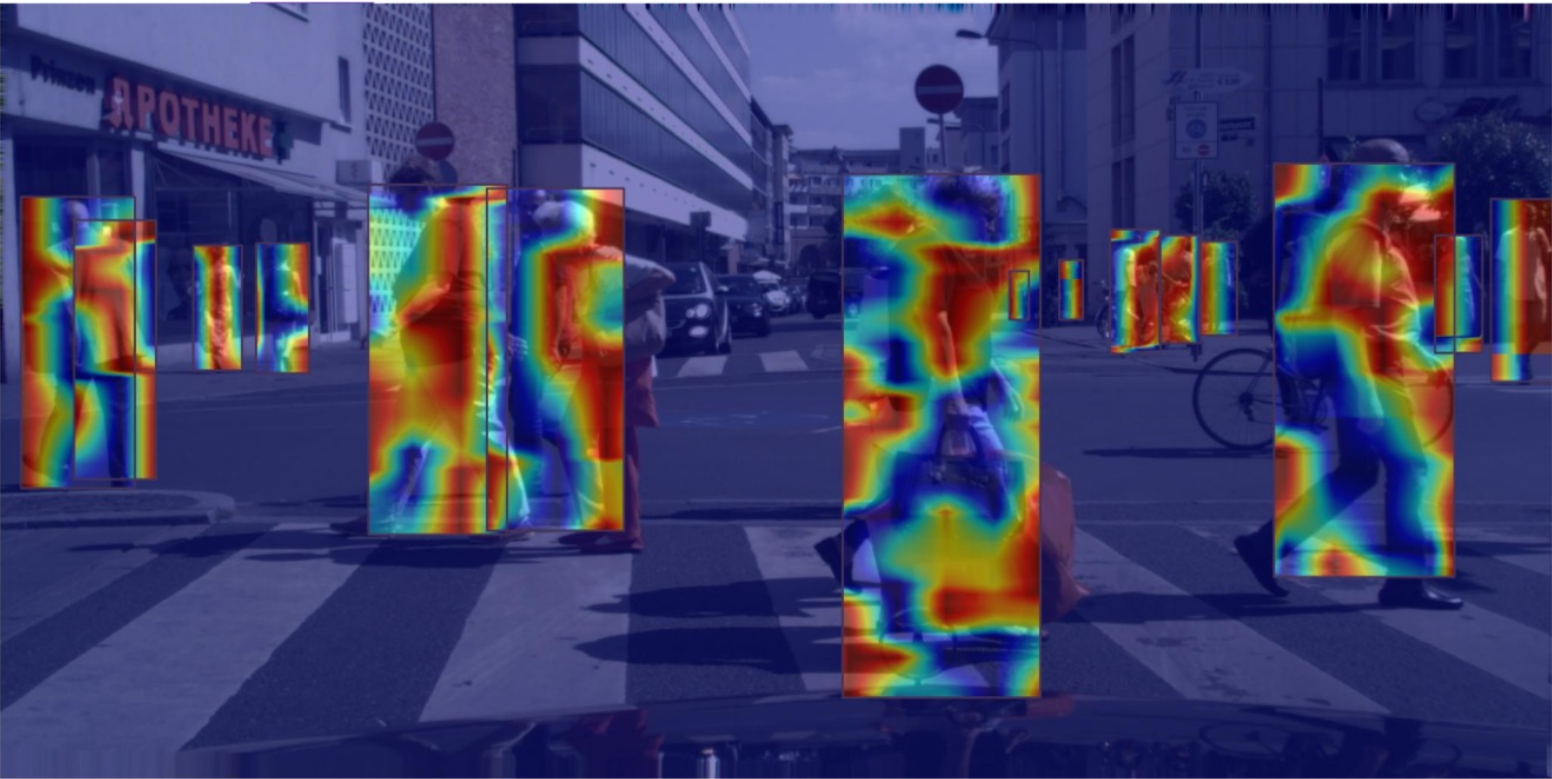
Augmentation CUTMIX

Filter 016

#	Image Name	# of Targets	# of Detections	# of False Negatives	# of False Positives
99	frankfur_000001_016462_leftimg8bit	19	13	7	2
87	frankfur_000001_013016_leftimg8bit	24	15	10	2
98	frankfur_000001_016273_leftimg8bit	14	8	7	1
214	frankfur_000001_062016_leftimg8bit	8	8	1	1
493	munster_000166_000019_leftimg8bit	8	4	5	1

Items per page: 5 1 - 5 of 20

Statistics Activations Grad-CAM Layer-wise Relevance Propagation (LRP) - Conti SHAP - IAIS Network Dissection - IAIS TCAV - Conti/DFKI RISE - DFKI MALALA



Layerwise Relevance Propagation



← Menu Current Model: FRCNN_CITYPERSONS_NO_AUG_EVALUATED_CITYPERSONS_VALIDATE

CONFIDENCE THRESHOLD: 90% ○ TARGETS ● DETECTIONS

Prediction Type: ALL

Object Class: PEDESTRIAN

Augmentation: CUTMIX

Filter: 016

#	Image Name	# of Targets	# of Detections	# of False Negatives	# of False Positives
99	frankfurt_000001_016462_leftimg8bit	19	13	7	2
87	frankfurt_000001_013016_leftimg8bit	24	15	10	2
98	frankfurt_000001_016273_leftimg8bit	14	8	7	1
214	frankfurt_000001_062016_leftimg8bit	8	8	1	1
493	munster_000166_000019_leftimg8bit	8	4	5	1

Items per page: 5 | 1 - 5 of 20

Original Selected for Visualizations

Statistics | Activations | Grad-CAM | **Layer-wise Relevance Propagation (LRP) - Conti** | SHAP - IAIS | Network Dissection - IAIS | TCAV - Conti/DFKI | RISE - DFKI | MALALA

Pedestrians
Pedstrian: 1

LRP Visualizer

SHAP IAIS



← Menu Current Model: FRCNN_CITYPERSONS_NO_AUG_EVALUATED_CITYPERSONS_VALIDATE

CONFIDENCE THRESHOLD 90% TARGETS DETECTIONS

Prediction Type: ALL

Object Class: PEDESTRIAN

Augmentation: CUTMIX

Filter: 016

#	Image Name	# of Targets	# of Detections ↓	# of False Negatives
99	frankfurt_000001_016462_leftimg8bit	19	13	7
87	frankfurt_000001_013016_leftimg8bit	24	15	10
98	frankfurt_000001_016273_leftimg8bit	14	8	7
214	frankfurt_000001_062016_leftimg8bit	8	8	1
493	munster_000166_000019_leftimg8bit	8	4	5

Items per page: 5 1 - 5 of 20

Original Selected for Visualizations

Relevance scores

Global bodypart relevance

Bodypart	Relevance Score (approx.)
face	0.16
left upper arm	0.01
right upper arm	0.01
left lower arm	0.01
right lower arm	0.01
left hand	0.01
right hand	0.01
torso	0.10
left upper leg	0.01
right upper leg	0.01
left lower leg	0.02
right lower leg	0.02
left foot	0.01
right foot	0.01

Local bodypart relevance



← Menu Current Model: F2DNET_CITYPERSONS_EVALUATED_CITYPERSONS_VALIDATE

CONFIDENCE THRESHOLD: 80%

TARGETS DETECTIONS

Prediction Type: ALL

Object Class: PEDESTRIAN

Augmentation: AUGMIX

Filter

#	Image Name	# of Targets	# of Detections	# of False Negatives
72	frankfurt_000001_009058_leftimg8bit	7	4	5
59	frankfurt_000001_004736_leftimg8bit	6	0	5
35	frankfurt_000000_014480_leftimg8bit	4	3	1
37	frankfurt_000000_015676_leftimg8bit	2	0	2
62	frankfurt_000001_005410_leftimg8bit	12	4	7

Items per page: 5 1 - 5 of 487

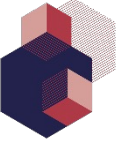
Original Selected for Visualizations

Statistics Activations Grad-CAM Layer-wise Relevance Propagation (LRP) - Conti SHAP - IAIS Network Dissection - IAIS **TCAV - Conti/DFKI** RISE

TCAV scores for each concept

Layer	Concept:1_leg	Concept:2_head	Concept:3_arm
5.conv	0.45	0.45	0.45
7.conv	0.40	0.45	0.45
10.conv	0.65	0.65	0.60
14.conv	0.85	0.75	0.60

face



← Menu Current Model: F2DNET_CITYPERSONS_EVALUATED_CITYPERSONS_VALIDATE

CONFIDENCE THRESHOLD: 80% ● TARGETS ○ DETECTIONS

Prediction Type: ALL

Object Class: PEDESTRIAN

Augmentation: AUGMIX

Filter

#	Image Name	# of Targets	# of Detections	# of False Negatives	# of False Positives
493	munster_000166_000019_leftImg8bit	8	2	6	0
337	munster_000010_000019_leftImg8bit	8	3	5	0
72	frankfurt_000001_009058_leftImg8bit	7	4	5	2
201	frankfurt_000001_058057_leftImg8bit	7	0	7	0
230	frankfurt_000001_066438_leftImg8bit	7	5	1	0

Items per page: 5 151 - 155 of 487

Original Selected for Visualizations

Augmented

Statistics Activations Grad-CAM Layer-wise Relevance Propagation (LRP) - Conti SHAP - IAIS Network Dissection - IAIS TCAV - Conti/DFKI **RISE - DFKI** MALALA



← Menu Current Model: MALALA

CONFIDENCE THRESHOLD: 80% ● TARGETS ○ DETECTIONS

Prediction Type: ALL

Object Class: PEDESTRIAN

Augmentation: AUGMIX

Filter

#	Image Name	# of Targets	# of Detections	# of False Negatives	# of False Positives
5	n009-2018-07-03-14-33-42-0400_CAM_FRONT_1530643381762656	6	14	4	3
6	n019-2018-08-01-12-04-35+0800_CAM_FRONT_1533096438112407	11	2	11	1
7	n014-2018-07-31-14-50-02-0400_CAM_FRONT_1533063363362509	11	8	10	3
8	n008-2018-05-30-15-20-59-0400_CAM_FRONT_1527708881262465	8	11	6	0
9	n016-2018-07-06-12-27-13+0800_CAM_FRONT_1530851465112515	4	2	4	0

Items per page: 5 6 - 10 of 10

Augmented

n009-2018-07-03-14-33-42-0400_CAM_FRONT_1530643381762656

Pedestrian Id: 0

index: 0 Exemplar Saliency map

Pedestrian Id: 1

index: 1 Exemplar Saliency map

Pedestrian Id: 2

index: 2 Exemplar Saliency map

Pedestrian Id: 3

index: 3 Exemplar Saliency map

Rule Discovery



↑
Rule Model: ECLAIRE

Dataset

Filter

Timestamp	LM0_type	LM1_type	LM2_type	LA0_width	LA1_width	TempoLimit	Vehicle0_P_x	Vehicle0_S	Vehicle0_E_x
54.0	1	0	0	3.5	3.5	50	1.5	12.5	1.6
75.3	1	0	0	3.5	3.5	50	1.5	12.5	1.6
37.9	3	0	0	3.5	3.5	50	1.5	12.5	1.6
46.1	1	0	0	3.5	3.5	50	1.5	12.5	1.6
89.8	2	0	0	3.5	3.5	50	1.5	12.5	1.6

Items per page: 1 - 5 of 1000

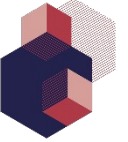
Features Frequency

Rules
ECLAIRE

Body ↑	Head
IF (0.6275 1.0000)[[LM0_type <= 0]]	NotRuleException
IF (0.8271 1.0000)[[LM0_type <= 2] AND (Vehicle1_Block_vehicle0_onLA0 > 0) AND (Waiting_time <= 5)]	NotRuleException
IF (0.8315 1.0000)[[Vehicle1_S > 0]] OR (0.8731 1.0000)[[Timestamp > 79.3] AND (Waiting_time <= 5)]	NotRuleException
IF (0.8767 1.0000)[[Timestamp <= 6.6] AND (Waiting_time <= 25) AND (Waiting_time > 11)] OR (0.8962 1.0000)[[Waiting_time <= 5]] OR (0.9060 1.0000)[[Vehicle1_S > 0.3] AND (Waiting_time <= 17)]	NotRuleException
IF (0.9480 1.0000)[[LM0_type <= 0] AND (Vehicle1_Block_vehicle0_onLA0 > 0)]	NotRuleException

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Driving Decision



- Jobs: Manage Analysis Jobs
- Results: Explore Analysis Results
- Rules
- Autonomous Driving Decisions





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Funded by
the European Union
NextGenerationEU

Supported by:



on the basis of a decision
by the German Bundestag

www.kiwissen.de

 @KI_Familie

 KI Familie