

Contents

1	Introduction	1
2	Machine Learning for Object Detection	5
2.1	Introduction	5
2.2	Machine learning	7
2.2.1	Ensemble learning	8
2.2.2	Connectionism	16
2.3	Proposal generation	26
2.4	Feature representation	28
2.5	Clustering the detections	34
3	Datasets and Methodology	39
3.1	Introduction	39
3.2	Pedestrian detection	39
3.2.1	Caltech benchmark	42
3.2.2	Kitti benchmark	44
3.3	Traffic sign samples	45
4	Aggregated Channels Network A Novel Approach for Detecting Pedestrians in Real Time	47
4.1	Motivation	47
4.1.1	Related work	48
4.1.2	Contribution	49

4.2	Aggregated channel network	50
4.2.1	Proposal generation	50
4.2.2	Proposal evaluation	51
4.3	Implementation details	54
4.3.1	Dataset	54
4.3.2	Operational point	54
4.3.3	Collecting training set	55
4.3.4	Training ACNet	57
4.3.5	Extending the pipeline	58
4.3.6	Improving the quality of the proposals	61
4.4	Experiments	64
4.4.1	Comparison to the state-of-the-art methods	66
4.4.2	Runtime analysis	69
4.5	Epilogue	71
5	Insatiate Cascaded Boosted Forest A Novel Approach for Exploiting the Asymmetry of the Dataset	73
5.1	Motivation	73
5.1.1	Related work	75
5.1.2	Contribution	77
5.2	Ensemble	77
5.2.1	Dataset	77
5.2.2	Sampling	78
5.2.3	Model settings	79
5.3	Exploiting the asymmetry	80
5.3.1	Preliminary experiment	80
5.3.2	Greedily bootstrapping	82
5.3.3	Positive mining	83

5.3.4	Model parameters	85
5.4	Experiments	87
5.4.1	Comparison to the state-of-the-art methods	89
5.5	Epilogue	92
6	Conditional Multichannel Generative Adversarial Networks A Novel Approach for Generating Synthetic Traffic Signs	93
6.1	Motivation	93
6.1.1	Related work	94
6.1.2	Contribution	96
6.2	Evolving the modeling framework	97
6.2.1	Input signal	97
6.2.2	Generative adversarial networks	98
6.2.3	Architectural design	99
6.2.4	Multichannel GANs	102
6.2.5	Conditional MCGANs	103
6.3	Experiments	106
6.3.1	A closer examination of synthetic traffic signs	106
6.3.2	Quality of the generated samples	109
6.3.3	Pixel to subpixel generator	110
6.4	Epilogue	112
7	Conclusion and Discussion	113
	Bibliography	119