

CONTENTS

1	Introduction	1
1.1	Depth Estimation	1
1.1.1	Background	1
1.1.2	Passive Depth Sensing	1
1.2	Light Fields	4
1.2.1	4D Light Field Representation	5
1.2.2	3D Light Field Representation	5
1.2.3	Baseline	6
1.3	Motivation	6
1.4	Contribution	8
1.5	Outline	9
2	Light Field Datasets, Metrics and Previous Works	13
2.1	Datasets	13
2.1.1	Acquisition	13
2.1.2	Classification	16
2.1.3	Scene Illustration	17
2.1.4	Statistics	18
2.1.5	Challenge Attribute	19
2.1.6	Proposed WLF Dataset	21
2.1.7	Testing Datasets	22
2.2	Metrics	24
2.3	State-of-the-art	25
2.3.1	Depth From 3D Light Fields	26
2.3.2	Depth From 4D Light Fields	28
I	Traditional Algorithms	37
3	Depth Estimation from Wide-baseline 3D Light Fields	39
3.1	Introduction	39
3.2	Methodology	40
3.2.1	Bivariate Kernel Density Estimation	40
3.2.2	Edge Map and Non-edge Map	42

CONTENTS

3.2.3	Cost Volume Filtering	42
3.2.4	Confidence Computation and Depth Fusion	43
3.2.5	Propagation	44
3.2.6	Optimization	44
3.3	Exemplar Results	45
4	Depth Estimation from 4D Light Fields	47
4.1	Introduction	47
4.2	Methodology	48
4.2.1	Cost Volume Computation	48
4.2.2	Occlusion Handling	49
4.2.3	Optimization	51
4.3	Exemplar Results	52
II	CNN-based Algorithms	55
5	Depth Estimation from Narrow-baseline 4D Light Fields	57
5.1	Introduction	57
5.2	Related Work	58
5.3	Review of EPINET	59
5.4	Methodology - I	59
5.4.1	EPI Patch Subnetwork	60
5.4.2	Context Subnetwork	61
5.4.3	Fusion Subnetwork	62
5.4.4	Training Loss	63
5.4.5	Implementation Details	63
5.4.6	Ablation Study	64
5.5	Methodology - II	64
5.5.1	Network Architecture	65
5.5.2	Modules	67
5.5.3	Training Loss	68
5.5.4	Implementation Details	68
5.5.5	Ablation Study	69
5.6	Exemplar Results	69
6	Depth Estimation from Wide-baseline 4D Light Fields	71
6.1	Introduction	71
6.2	Methodology	72
6.2.1	Feature Extraction	74

6.2.2	Cost Volume Generation	74
6.2.3	Cost Aggregation	76
6.2.4	Disparity Regression	77
6.2.5	Training Loss	77
6.2.6	Implementation Details	77
6.2.7	Ablation Study	78
6.3	Exemplar Results	80
7	Experiments	83
7.1	Experimental Environment	83
7.2	3D Light Fields	83
7.3	4D Light Fields	84
7.3.1	Performance on Narrow-baseline Datasets	84
7.3.2	Performance on Wide-baseline Datasets	88
7.3.3	Baseline	95
8	Conclusion	99
8.1	Summary	99
8.2	Future Work	101
Appendices		103
Acronyms		105
List of Figures		107
List of Tables		111
List of Publication		113
Bibliography		115