

Contents

Acknowledgements	iii
Abstract	v
Zusammenfassung	vii
Contents	xi
1 Introduction	1
1.1 Time Series Analysis	3
1.1.1 Machine Learning	5
1.1.2 Deep Learning	11
1.2 Pain	22
1.2.1 Physiological Aspects of Pain	24
1.2.2 Pain Assessment	31
1.2.3 Experimental Studies of Pain	36
1.3 Motivation	39
1.4 Contribution	43
1.5 Overview	45
2 Feature Extraction in Pain Recognition	47
2.1 Problem Statement	47
2.2 Related Work	57
2.3 Comparison of Feature Extraction Methods	64
2.3.1 Data sets	66
2.3.2 Framework	76
2.4 Experimental setup	97
2.4.1 Implementation details	97
2.5 Results	101
2.6 Summary	110

3 Explainable Artificial Intelligence in Pain Research	113
3.1 Problem Statement	114
3.2 Related Work	116
3.3 Framework	118
3.3.1 Preprocessing	119
3.3.2 DL models	119
3.3.3 XAI in RFs	123
3.3.4 XAI in DL	125
3.4 Experimental Setup	128
3.4.1 Implementation details	129
3.5 Results	134
3.6 Summary	151
4 Conclusion	155
4.1 Summary	155
4.2 Scientific Findings	157
4.3 Limitations	159
4.4 Future work	160
Bibliography	163
List of Own Publications	195
List of Abbreviations	197
List of Tables	201
List of Figures	203
Mathematical Symbols	205