

Contents

Contents	ix
1 Introduction	1
1.1 Motivation	1
1.2 Hypothesis	3
1.3 Goals	3
1.4 Contributions	4
1.5 Projects and Partners	5
1.6 Summary of the remaining chapters	6
2 Theoretical framework	9
2.1 Machine learning and Pattern recognition	9
2.2 Maximum likelihood estimation	13
2.3 Bayesian inference	14
2.4 Incremental learning	19
2.5 Evaluation	23
2.6 Magnetic Resonance Spectroscopy	24
3 Automatic brain tumour classification	27
3.1 Introduction	28
3.2 Data acquisition and pre-processing	29
3.3 Methods	32
3.4 Contributions in automatic brain tumour classification	34
3.5 Discussion and conclusions	38
4 Weighted Incremental Gaussian Discriminant Analysis	41
4.1 Introduction	42
4.2 Methods	42
4.3 Benchmark experiments	45
4.4 Experimental design for brain tumour diagnosis	50
4.5 Results in brain tumour classification with MRS	54
4.6 Discussion and conclusions	56
5 Incremental Bayesian discriminative logistic regression	63
5.1 Introduction	63
5.2 Bayesian Discriminative Logistic Regression	64
5.3 Materials	69

5.4 Results	72
5.5 Discussion	79
6 Concluding remarks and future work	83
6.1 Conclusions	83
6.2 Future work	85
A Gaussian Discriminant Analysis	87
B Logistic regression	91
Glossary	95
Bibliography	97
List of Figures	109
List of Tables	111