
Contents

Abstract	v
Resumen	vii
Resum	ix
Preface	xi
Contents	xv
1 Scientific Goals	1
2 Preliminaries	3
2.1 Introduction	4
2.2 State-of-the-art in Handwritten Text Recognition (HTR)	5
2.3 The Handwritten Text Recognition Process	6
2.4 Theoretical Background of HTR	8
2.4.1 Hidden Markov Character Models (HMMs)	9
The Learning Problem	11
The Decoding Problem	12
2.4.2 n -gram Language Models	13
2.5 Interactive HTR	14
2.6 Interactive HTR in this thesis	15
Bibliography	19
3 Interactive Pattern Recognition	23
3.1 Introduction	24
3.2 Interactive Pattern Recognition	25

3.3	Interactive Handwriting Recognition	26
3.4	Interactive Document Layout Analysis	30
3.5	Conclusions	31
	Bibliography	33
4	Annotation of Handwritten Text Documents	35
4.1	Introduction	36
4.2	Annotation of GERMANA and RODRIGO	36
4.2.1	GERMANA	36
4.2.2	RODRIGO	40
4.3	Baseline Experiments	42
4.3.1	Basic Parameter estimation	44
4.3.2	Punctuation marks isolation	44
4.3.3	Feature Extraction Methods	46
4.3.4	Explicit blank recognition	47
4.3.5	Results on the whole document	47
4.3.6	Closed vocabulary recognition	50
4.3.7	External Resources	51
4.4	Conclusions & Future Work	53
	Bibliography	55
5	Interactive Handwriting Recognition with limited user effort	57
5.1	Introduction	58
5.2	Confidence Measures	59
5.3	Active Learning: Selecting words to be supervised	61
5.4	User Supervision	62
5.4.1	Constrained Viterbi-based search	63
	Recomputation strategies	65
5.5	Adaptation from Partially Supervised Words	69
5.6	Experiments	71
5.6.1	User Interaction Model	72
5.6.2	Interactive Experiments	73
5.7	Conclusions & Future Work	80
	Bibliography	83
6	Balancing Error and Supervision Effort in Interactive Handwriting Recognition	85
6.1	Introduction	86
6.2	Error Estimation in Automatically Recognised Words	86
6.2.1	Line-based Prediction	87
6.2.2	Block-based Prediction	88
6.3	Experiments	90
6.4	Conclusions & Future Work	96
	Bibliography	99

7	Conclusions	101
7.1	Summary	102
7.2	Scientific Publications	103
7.3	Future Work	105
	Bibliography	109
8	Scientific Contributions	111
A	The GIDOC Prototype	113
A.1	Introduction	114
A.2	System Overview	114
A.3	Preferences	116
A.4	Block Detection	117
	A.4.1 Projection-based Block Detection	117
	A.4.2 History-based Block Detection	118
A.5	Line Detection	119
A.6	Preprocessing	121
A.7	Feature Extraction	122
A.8	Training	123
A.9	Transcription	124
A.10	Conclusions & Future Work	125
	Bibliography	127
	List of Figures	129
	List of Tables	133