Contents

Abstract ii

Resumen iii

Resum v

Acknowledgements vii

1 Introduction 1
1.1 Motivation and goals of this work 2
1.2 Previous works on ceramic tiles 4
1.3 Thesis outline 6

2 Overview of surface grading works 9
2.1 Surface features 10
  2.1.1 Colour 10
  2.1.2 Texture 12
  2.1.3 Colour and Texture 16
2.2 Surrey works on surface grading 17
2.3 CVC works on surface grading 25
2.4 Oulu works on surface grading 30
2.5 Other minor works 33
2.6 Conclusions 35

3 VxC TSG image database 37
3.1 Acquisition system 38
3.1.1 Scan Line Camera ................................. 39
3.1.2 Optical lenses ................................. 41
3.2 Study of spatial and temporal uniformity........ 42
3.3 VxC TSG description ............................. 46
3.4 Conclusions ................................. 51

4 On the search for a fast and accurate approach to surface grading 53
4.1 Image tessellation and local Lab statistics .......... 54
4.2 Global Lab statistics ............................ 60
4.3 Literature methods .............................. 62
4.4 Conclusions ................................. 64

5 Extraction of soft colour-texture descriptors method 65
5.1 CIE Lab and CIE Luv ............................ 66
5.2 Soft colour-texture descriptors ................... 68
5.3 Classifiers ................................. 70
5.4 Experiments and results .......................... 74
  5.4.1 Experimental design .......................... 76
  5.4.2 Logistic regression .......................... 78
  5.4.3 Selection of best combinations ............... 82
  5.4.4 Results .................................. 82
5.5 Conclusions ................................. 88

6 Literature methods ............................... 90
6.1 Colour histograms ................................ 90
6.2 Centile-LPB .................................. 93
6.3 Experimental design and results ................. 95
6.4 Comparison with soft colour-texture descriptors method .... 106

7 Study of real-time compliance .................... 108
7.1 Sequential inspection process ................... 109
7.2 Tile extraction ................................ 111
7.3 Data scaling vs real-time compliance .......... 112
Contents

7.4 MPI-Cluster architecture ........................................... 114
7.5 Parallelization experiments and results ......................... 115
7.6 Conclusions .......................................................... 121

8 Conclusions, discussion and further work ....................... 123

A Image registration method for ceramic tiles .................... 129
  A.1 Introduction ....................................................... 129
  A.2 Registration method ............................................. 130
  A.3 Experiments and results ........................................ 134

Bibliography ............................................................ 138