Contents

1 Introduction **1**
- 1.1 Thesis contributions . . . 4
- 1.2 Publications . . . 5
- 1.3 Thesis outline . . . 6

2 Preliminaries **7**
- 2.1 Relevance in IR Systems . . . 7
- 2.2 The Triad of Search: User, Query and (Multimedia) Document . . . 8
  - 2.2.1 The User . . . 8
  - 2.2.2 The Query . . . 10
  - 2.2.3 The Multimedia Document . . . 12
- 2.3 Expressing an Information Need . . . 14
  - 2.3.1 The Intention Gap . . . 14
  - 2.3.2 Query disambiguation . . . 15
- 2.4 Retrieving Multimedia Documents on the Web . . . 17
  - 2.4.1 The Semantic Gap . . . 18
  - 2.4.2 Multimedia Context Data . . . 19
  - 2.4.3 Multimedia Retrieval System . . . 22
- 2.5 Assessing Search Results . . . 22
  - 2.5.1 Presenting the Results . . . 23
  - 2.5.2 User Interaction . . . 25
  - 2.5.3 Evaluation . . . 27
- 2.6 Summary . . . 35

3 Related Work **36**
- 3.1 Topic Discovery on Multimedia . . . 36
  - 3.1.1 Multimedia search results clustering . . . 36
  - 3.1.2 Community detection for topic discovery . . . 38
- 3.2 Automatic Multimedia Tagging . . . 39
  - 3.2.1 Analyzing context data to tag multimedia . . . 40
  - 3.2.2 Combining content and context data to tag multimedia . . . 40
- 3.3 Human Evaluation in Multimedia-related Scenarios . . . 41
- 3.4 Summary . . . 42

4 Topic Identification in Multimedia Search Results **44**
- 4.1 Framework for Detecting Multimedia-related Concepts . . . 45

4.1.1 Overview . . . 45
4.1.2 Tag Graph Construction . . . 47
4.1.3 Community Detection Algorithm . . . 48
4.2 Adaptive Island Cuts for Topic Detection . . . 49
4.2.1 Islands . . . 49
4.2.2 Island hierarchy based on edges . . . 50
4.2.3 Island hierarchy based on vertices . . . 52
4.2.4 Adaptive island cuts . . . 55
4.3 Experiments . . . 59
4.3.1 Dataset . . . 59
4.3.2 Algorithms . . . 60
4.3.3 User study design . . . 62
4.3.4 Inter-assessors agreement . . . 64
4.3.5 Majority-voting Precision . . . 67
4.3.6 Data-driven Recall . . . 69
4.3.7 Ontology-based Cohesion . . . 71
4.3.8 Correlation between User Opinion and Tag Graph . . . 74
4.3.9 Discussion . . . 75
4.4 Conclusions . . . 76

5 Automatic Tagging of Multimedia Resources 77
5.1 Framework for Automatic Multimedia Tagging . . . 78
5.1.1 Overview . . . 78
5.1.2 Visual-Semantic graph . . . 79
5.2 Characterizing Visual Information Needs . . . 81
5.3 Propagating Tags on the Visual-Semantic graph . . . 82
5.3.1 Stop-images . . . 82
5.3.2 Weighting schema and pruning indicators . . . 83
5.3.3 Bounded propagation of tags . . . 84
5.4 Experiments . . . 86
5.4.1 Dataset . . . 86
5.4.2 Sample selection . . . 88
5.4.3 Automatic Tagging Exploratory Analysis . . . 89
5.5 Conclusions . . . 89

6 Conclusions and Future Work 91
6.1 Main Results . . . 91
6.2 Limitations . . . 94
6.3 Future Work . . . 95

Bibliography 97

A Benford's Law and Zipf's Law 109
A.1 Benford's Law . . . 109
A.2 Zipf's Law . . . 110