

# Glossary

This chapter contains a list of all the abbreviations used in this dissertation.

**ACM** Advanced Computing Machinery

**AGFA** Actien-Gesellschaft für Anilin-Fabrikation (an imaging company)

**ALOI** Amsterdam Library of Object Images

**AMI** Augmented Multi-party Interaction (video retrieval evaluation event)

**AP** Average Precision

**API** Application Programming Interface

**ARGOS** Evaluation Campaign for Surveillance Tools of Video Content (French)

**ART** Angular Radial Transform

**AUC** Area Under Curve

**AVG** Average

**BG** Background

**BPREF** Binary Preference

**CBIR** Content-Based Image Retrieval

**CBIRS** Content-Based Image Retrieval System

**CCV** Colour Coherence Vector

**CCTV4** China Central Television 4

**CEA** Commissariat à l'Énergie Atomique (French Atomic Energy Commission)

**CFW** Collection Frequency Weight

**CGI** Common Gateway Interface

**CHI** Computer–Human Interaction

**CIE** Commission Internationale de l'Éclairage (International Commission of Illumination)

**CIS** Coin Images Seibersdorf

**CLEF** Cross–Language Evaluation Forum

**CLIR** Cross–Language Information Retrieval

**CMY** Cyan, Magenta, Yellow (color space)

**CNN** Cable News Network

**COIL** Columbia University Object Image Library

**CSS** Curvature Scale Space

**CT** Computer Tomography

**CV** Computer Vision

**DARPA** Defense Advanced Research Project Agency

**DB** Database

**DBMS** Database Management System

**DCU** Dublin City University

**DDL** Description Definition Language

**DFR** Divergence From Randomness

**DS** Description Scheme

**EER** Equal Error Rate

**EM** Expectation Maximisation

**ETISEO** Evaluation du Traitement et de l'Interprétation de Séquences Vidéo  
(Video Understanding Evaluation)

**FD** Fourier Descriptor

**FG** Foreground

**FIRE** Flexible Image Retrieval Engine

**GIFT** GNU Image Finding Tool

**GIR** Geographical Information Retrieval

**GIS** Geographical Information System

**GMAP** (geometric) Mean Average Precision

**GNU** GNU is Not Unix

**GPL** General Public License

**GRF** Gibbs Random Field

**GUI** Graphical User Interface

**HEAL** Health Education Assets Library

**HMMD** Hue Maximum Minimum Difference (colour space)

**HSB** Hue, Saturation, Brightness (colour space)

**HSV** Hue, Saturation, Value (colour space)

**HTML** Hypertext Markup Language

**HTTP** Hypertext Transfer Protocol

**IAPR** International Association for Pattern Recognition

**IBF** International Boxing Federation

**IBM** International Business Machines

**ID** Identification, unique identifier

**IDF** Inverse Document Frequency

**IEEE** Institute of Electrical and Electronics Engineers

**INEX** Initiative for the Evaluation of XML Retrieval

**IR** Information Retrieval

**IRMA** Image Retrieval in Medical Applications

**ISJ** Interactive Search and Judge (pooling method)

**JPEG** Joint Photographic Experts Group

**KLT** Karhunen-Loeve Transform

**LBC** Lebanese Broadcasting Corporation

**LCD** Liquid Crystal Display

**LNCS** Lecture Notes in Computer Science

**LSE** Least Significant Element

**LSI** Latent Semantic Indexing

**LSW** Least Significant Word

**LTU** Look That Up Technologies (company)

**MAP** (arithmetic) Mean Average Precision

**MARS** Multimedia Archival and Retrieval System(s)

**MFD** Minkowski-Form Distance

**MGRF** Markov-Gibbs Random Field

**MIR** Mallinckrodt Institute of Radiology

**MIRA** Multimedia Information Retrieval Applications

**MIRC** Medical Image Resource Centre

**MIT** Massachusetts Institute of Technology

**MPEG** Moving Picture Experts Group

**MRF** Markov Random Field

**MRI** Magnetic Resonance Imaging

**MRSAR** Multi-Resolution Simultaneous Auto Regressive texture model

**MSE** Most Significant Element

**MRR** Mean Reciprocal Rank

**MSN** Microsoft Network

**MSNBC** Microsoft Network / National Broadcasting Company

**MSW** Most Significant Word

**MT** Machine Translation

**MTF** Move To Front (pooling method)

**NBC** National Broadcasting Company

**NEC** Nippon Electric Company

**NII** National Institute of Informatics

**NIST** National Institute of Standards and Technology

**NLP** Natural Language Processing

**NTCIR** NII Test Collection for IR Systems

**NTDTV** New Tang Dynasty Television

**NTU** National Taiwan University

**OWL** Web Ontology Language

**PA** Place Adjunct

**PCA** Principal Component Analysis

**PEIR** Pathology Educational Instructional Resource

**PETS** Performance Evaluation of Tracking and Surveillance

**PHP** PHP: Hypertext Preprocessor

**PNG** Portable Network Graphics

**PR** Pattern Recognition

**PR graph** Precision *vs.* Recall graph

**QBE** Query by Example

**QBIC** Query by Image Content

**QBK** Query by Keyword

**QBS** Query by Sketch

**QFD** Quadratic Form Distance

**RDF** Resource Description Framework

**RF** Relevance Feedback

**RGB** Red, Green, Blue (colour space)

**RIA** Reliable Information Access (workshop)

**RISAR** Rotation-Invariant Simultaneous Auto-Regressive texture model

**ROC** Receiver Operator Characteristic

**SAC** St. Andrews Collection of historic photographs

**SAR** Simultaneous Auto-Regressive texture model

**SGML** Standard Generalised Markup Language

**SIGIR** Special Interest Group on Information Retrieval

**SIR** Semantic Image Retrieval

**SOIL** Surrey Object Image Library

**SOM** Self Organising Map

**SPEC** Standard Performance Evaluation Corporation

**SQL** Structured Query Language

**TA** Time Adjunct

**TBIR** Text-Based Image Retrieval

**TBIRS** Text-Based Image Retrieval System

**TC** Technical Committee

**TF** Term Frequency

**TFM** Ternary Fact Model

**TPC** Transaction Processing Performance Council

**TREC** Text REtrieval Conference

**TUC** Technical University Chemnitz

**URL** Uniform Resource Locator

**USA** United States of America

**USD** United States Dollar

**VIPER** Visual Information Processing for Enhanced Retrieval

**VIR** Visual Information Retrieval

**VIRS** Visual Information Retrieval System

**VOC** Visual Object Classes

**WBA** World Boxing Association

**WBC** World Boxing Council

**WBO** World Boxing Organisation

**WJM** Wolf Jolion Metric

**WWW** World Wide Web

**XML** eXtensible Markup Language

# Notation

This chapter explains the mathematical notation used throughout this dissertation to keep it as homogeneous as possible. It also provides a link to where the symbol was used for the first time to get further information on it.

$|\cdot|$  Cardinality of a set (introduced in Equation 5.4)

$A$  Similarity matrix (introduced in Equation 2.8)

$AP$  Average precision (defined in Equation 3.3)

$AP_i$  Average precision for topic  $i$  (introduced in Equation 3.4)

$a_{ij}$  Similarity between  $i$  and  $j$  (introduced in Equation 2.8)

$B$  The number of bins in a histogram (introduced on Page 70)

$b$  Tuning constant (used in Equation 2.5)

$bpref$  Binary preference (defined in Equation 3.11)

$C$  Covariance matrix of feature vectors (introduced in Equation 2.9)

$cov(X, Y)$  Covariance of two variables  $X$  and  $Y$  (used in Equation 5.17)

$\mathcal{D}$  Set of documents in a collection (introduced on Page 67)

$D$  Number of documents in a collection (introduced in Equation 2.2)

$D_j$  Text document in a collection (introduced on Page 67)

$D(I, J)$  Distance between images  $I$  and  $J$  (introduced on Page 70)

$d$  Topic difficulty (defined in Equation 5.16)

$d_j$  Topic difficulty for iteration  $j$  (defined in Equation 5.15)

$d(\mathcal{T}, \mathcal{I})$  Topic difficulty of topic  $\mathcal{T}$  for image collection  $\mathcal{I}$  (defined in Equation 5.16)

$df$  Document frequency (defined in Equation 5.14)

$dl(j)$  Document length, length of document  $D_j$  (introduced on Page 67)

$E(X)$  Expected value of variable  $X$  (used in Equation 5.17)

$ER$  Retrieval experiment error rate (defined in Equation 7.1)

$er$  Error rate (defined in Equation 3.13)

$F_I$  Feature vector for image  $I$  (introduced in Equation 2.8)

$f$  Fuzziness value (introduced on Page 310)

$f_i(I)$  Number of pixels in bin  $i$  of image  $I$  (introduced on Page 70)

$GMAP$  Geometric mean average precision (defined in Equation 3.5)

$H$  Entropy of objects in an image (defined in Equation 4.2)

$H_{max}$  Maximum entropy of objects in an image (defined in Equation 4.4)

$H(I, J)$  Hausdorff distance between images  $I$  and  $J$  (defined in Equation 2.10)

$\vec{h}(I, J)$  Directed Hausdorff distance from image  $I$  to  $J$  (defined in Equation 2.11)

$\mathcal{I}$  Set of images in the collection (introduced in Equation 5.16)

$I, J$  Images (introduced on Page 70)

$i, j, k, l$  Counters for various purposes

$idf(i)$  Inverse document frequency of term  $t_i$  (defined in Equation 2.2)

$K$  Number of topic elements (introduced in Equation 5.2)

$K_1$  Tuning constant (used in Equation 2.5)

$L_1$  Manhattan distance (described on Page 71)

$L_2$  Euclidean distance (described on Page 71)

$m_{p,q}$  Algebraic moment of order  $p + q$  (defined in Equation 2.1)

$MAP$  Un-interpolated mean average precision (defined in Equation 3.4)

$MRR$  Mean reciprocal rank of relevant images (defined in Equation 3.10)

$\mathcal{N}$  Set of images retrieved (introduced in Equation 5.5)

$\mathcal{N}_D$  Set of retrieved images through direct hits (introduced in Equation 5.4)

$N$  Number of images in the collection (introduced on Page 141)

$N_{\mathcal{O}}$  Number of objects in an image (described on Page 174)

$N_{\mathcal{O}}(i)$  Number of objects of type  $i$  in an image (introduced in Equation 4.3)

$N_R$  Number of binary relations in an image (defined in Equation 4.5)

$N_{Rmax}$  Maximum number of binary relations (defined in Equation 4.6)

$N_T$  Number of object types in an image (introduced in Equation 4.2)

$n$  Number of retrieved images (introduced in Equation 3.1)

$n_{cc}$  Number of correctly classified images (introduced in Equation 3.14)

$n_{co}$  Number of image types correctly classified at least once (introduced in Equation 3.14)

$n_{cu}$  Number of images classified as unknown (introduced in Equation 3.14)

$n_{cw}$  Number of wrongly classified images (introduced in Equation 3.14)

$n_r$  Number of relevant images retrieved (introduced in Equation 3.1)

$n_{rjn}$  The first  $r$  judged non-relevant images (introduced in Equation 3.11)

$ndl(j)$  Normalised length of document  $D_j$  (defined in Equation 2.3)

$\mathcal{O}$  Set of objects in an image (introduced on Page 174)

$P$  Precision (defined in Equation 3.1)

$PT$  Proportion of ties (defined in Equation 7.2)

$P_i$  Precision for image  $i$  (introduced in Equation 3.4)

$P(n)$  Precision after  $n$  images are retrieved (introduced on Page 141)

$P(r)$  R-precision (introduced on Page 142)

$p, q$  Order (introduced in Equation 2.1)

$p_i$  Likelihood of the occurrence of object  $i$  in an image (defined in Equation 4.3)

$Q$  Total number of query topics (introduced in Equation 3.4)

$\mathcal{R}$  Set of relevant images for all topic sentence elements (defined in Equation 5.3)

$\mathcal{R}_j$  Set of relevant images for all topic sentence elements in iteration  $j$  (introduced in Equation 5.3)

$\mathcal{R}_j^*$  Set of relevant images for the most significant topic element in iteration  $j$  (defined in Equation 5.13)

$\mathcal{R}_{j,k}$  Set of relevant images for the  $k^{th}$  topic element in iteration  $j$  (described on Page 216)

$\mathcal{R}_R$  Set of relevant images retrieved (introduced in Equation 3.8)

$R$  Recall (defined in Equation 3.2)

$R(n)$  Recall after  $n$  images are retrieved (described on Page 141)

$r$  Number of relevant documents/images (introduced in Equation 2.2)

- $r_k$  The  $k^{th}$  relevant document/image (introduced in Equation 3.11)
- $Rank_1$  Rank of the first relevant image (introduced on Page 147)
- $Rank_k$  Rank of the  $k^{th}$  relevant image (introduced on Page 148)
- $Rank_{rec}$  Reciprocal Rank of the first relevant image (defined in Equation 3.8)
- $\overline{Rank}$  Average rank of relevant images (defined in Equation 3.9)
- $S$  MUSCLE CIS Score (defined in Equation 3.14)
- $\mathcal{T}$  Topic sentence (defined in Equation 5.2)
- $\mathcal{T}_j$  Set of topic elements for the  $j^{th}$  iteration (mentioned on Page 217)
- $T$  The transpose of a matrix (introduced in Equation 2.8)
- $t$  Topic sentence element (defined in Equation 5.1)
- $t_i$  Term  $i$  in a text document (introduced in Equation 2.2)
- $t_k$  The  $k^{th}$  topic element (introduced in Equation 5.2)
- $tf(i, j)$  Term frequency, number of occurrences of term  $t_i$  in document  $D_j$  (described on Page 67)
- $X, Y$  Variables used in Pearson's product moment correlation (introduced in Equation 5.17)
- $x, y$  Coordinates (used in Equation 2.1)
- $\alpha$  Factor for vocabulary mismatch and incomplete and incorrect annotation (defined in Equation 5.4)
- $\beta$  Factor for element ambiguity (defined in Equation 5.5)
- $\gamma$  Annotation gap factor (defined in Equation 5.6)
- $\eta$  Tuning constant (introduced in Equation 5.6)

$\theta$  Tuning constant (introduced in Equation 5.6)

$\lambda$  Constant for calculation of *GMAP* (introduced in Equation 3.7)

$\mu_X$  Mean value of random variable  $X$  (introduced in Equation 5.17)

$\rho$  Object repetitiveness (defined in Equation 4.1)

$\rho(X, Y)$  Pearson's product moment correlation (defined in Equation 5.17)

$\sigma_X$  Standard deviation of variable  $X$  (used in Equation 5.17)

$\tau$  Kendall's rank correlation coefficient (described on Page 317)

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