

Title: Matching Words and Pictures: Problems, and Applications in the Web

Contact Information:

Latifur Khan, Ph.D.

Associate Professor and Director of the UTD Data Mining and Database Laboratory
(DBL@UTD)

Department of Computer Science

Erik Jonsson School of Engineering and Computer Science
Box 830688, EC 31

University of Texas at Dallas
Richardson, TX 75083-0688

Email: lkhan@utdallas.edu Voice: (972) 883-4137
URL: <http://www.utdallas.edu/~lkhan> Fax.: (972) 883-2349

Abstract:

The development of technology generates huge amounts of non-textual information, such as images. An efficient image annotation and retrieval system is highly desired. Clustering algorithms make it possible to represent visual features of images with finite symbols. Based on this, many statistical models, which analyze correspondence between visual features and words and discover hidden semantics, have been published. These models improve the annotation and retrieval of large image databases.

In this tutorial, first, we will present current state of the art and its shortcomings. We will present some classical models (e.g., translation model (TM), cross-media relevance model etc.) including classification problems. Second, we will present weighted feature selection algorithm as a solution to the existing problem. For a given cluster, we determine relevant features based on histogram analysis and assign greater weight to relevant features as compared to less relevant features and enforce constraint during clustering. Third, we will present the continuous relevance model and multiple Bernoulli model for avoiding clustering. We will present mechanisms to link visual tokens with keywords based on these models. Fourth, we will present mechanisms to improve accuracy of classical model, TM by exploiting the WordNet knowledge-base. Fifth, we will present a framework to model semantic visual concept in video/images by fusing multiple evidence with the usage of an ontology. Sixth we will show that weighted feature selection is better than traditional ones (TM) for automatic image annotation and retrieval. Seventh, we will show that how we can re-formulate the removal of erroneous keywords from image annotation problem into graph-partitioning problem, which is weighted MAX-CUT problem and suggest various approaches including a deterministic polynomial time algorithm, namely, randomized approximation graph algorithm. Finally, we will discuss open problems and future directions in the domain of web images.

Aims/Learning objectives: To provide automated annotation of images/pictures.

Scope: Data Mining and Multimedia Information Management

Keywords: **Multimedia Information Retrieval, Image, and Data Mining**

Target Audience: Researchers and practitioners in the multimedia field with no previous or little knowledge about data mining and machine learning.

Prerequisites

Attendants are expected to have the following background:

- Knowledge of basic computer science principles and skills
- Familiarity with basic probability theory

Justification: In this tutorial our primary focus will be: how low level image features can be linked with keywords/high level concepts with the usage of clustering, classification. Note that all these topics are related to data mining and machine learning areas. However, how the low level features will be extracted from images will not be covered in this tutorial. We assume that we will use current state of the art from computer vision research, (i.e., blob-world, normalized cut etc.).

Duration: 2.5 3 hours

Enough material such as handouts and slides can be found at:

<http://www.utdallas.edu/~lkhan/WWW2005Final.pdf>

Curriculum Vitae
Latifur R Khan
Computer Science Department
University of Texas at Dallas, Richardson, TX 75083
lkhan@utdallas.edu

Education

Ph.D. in Computer Science, University of Southern California (USC), August, 2000

Dissertation: Ontology-based Information Selection.

M.S. in Computer Science, University of Southern California, December, 1996.

B.S. in Computer Science and Engineering, Bangladesh University of Engineering and Technology, November, 1993.

Work Experience

Associate Professor: Computer Science Dept., University of Texas at Dallas, since September, 2006.

Assistant Professor: Computer Science Dept., University of Texas at Dallas, since September, 2000.

Graduate Research Assistant: Integrated Media Systems Center, USC, September, 1997--Aug, 2000, and Information Sciences Institute (ISI), USC, Sept, 1995-Aug, 1997.

Recent Service to the Profession

- Half Day Tutorial, "Matching Words and Pictures - Problems, Applications, and Progress", in *14th ACM International World Wide Web Conference, WWW2005*, May 2005, Chiba, Japan, *DASFAA 2007*, Bangkok, Thailand, and in *MIS 2005 International Workshop on Multimedia Information Systems*, Sorrento, Italy.
- Associate Editor in the *International Journal of Computer Standards and Interfaces*, Elsevier Publisher, Netherlands, since June 2005.
- Program Committee Member of *12th ACM SIGKDD Conference on Knowledge Discovery and Data Mining*, Philadelphia, August, 2006.
- Program Committee Member of *6th IEEE International Conference on Data Mining (ICDM)*, Hong Kong, December, 2006.
- Program Committee Member of *11th ACM SIGKDD Conference on Knowledge Discovery and Data Mining*, Chicago, August, 2005.
- Program Committee Member of *Twelfth International Conference on Cooperative Information Systems (CoopIS)*, November 2005, Cyprus.
- Guest Editor, *International Journal of Knowledge and Information Systems (KAIS)* by Springer-Verlag, a special issue on "Multimedia Data Mining."
- Program Committee Member of *16th IEEE International Conference on Tools with Artificial Intelligence (ICTAI)*, November, 2004, Boca Raton, Florida.
- Program Committee Member of the *12th International Conference on Cooperative Information Systems (CoopIS 2004)*, Larnaca, Cyprus, 25-29 October, 2004.
- Program Committee Member of *IEEE International Conference on Multimedia & Expo (ICME)* July, 2003, Maryland.
- Invited Reviewer of *IEEE Transaction on Knowledge and Data Engineering (TKDE)*, *ACM Transaction on Information Systems (TOIS)*, *International Journal of Cooperative Information Systems (IJCIS)*, *International Journal of Knowledge and Information Systems (KAIS)* by Springer-Verlag.

Research Interests

Intrusion Detection, Data and application Security, Multimedia Information Management, Data Mining, Bio Informatics, Web-based Information Integration and management.

Selected Publications

- Yohan Jin, Kibum Jin, Latifur Khan, Balakrishnan Prabhakaran, “The Randomized Approximating Graph Algorithm for Image Annotation Refinement Problem,” *2008 IEEE Conference on Computer Vision and Pattern Recognition (CVPR), Workshop on the Semantic Learning Applications in Multimedia (SLAM), Alaska, USA, July 2008, (Best Paper Award)*.
- Y. Chin, L. Khan, L. Wang, M. Awad, “Image Annotations By Combining Multiple Evidence & WordNet” in *The Proc. of 13th Annual ACM International Conference on Multimedia (MM 2005)*, Singapore, November 2005, Page 706-715, (2005).
- L. Khan, D. McLeod, and E. Hovy, “Retrieval Effectiveness of Ontology-based Model for Information Selection,” *The VLDB Journal: The International Journal on Very Large Databases*, ACM/Springer-Verlag Publishing, Vol. 13(1): 71-85 (2004).
- L. Khan, M. Awad and B. Thuraisingham, "A New Intrusion Detection System using Support Vector Machines and Hierarchical Clustering," to appear *The VLDB Journal: The International Journal on Very Large Databases*, ACM/Springer-Verlag Publishing.
- B. M. Thuraisingham, G. Lavee, E. Bertino, J. Fan, L. Khan, "Access control, confidentiality and privacy for video surveillance databases," *11th ACM Symposium on Access Control Models and Technologies*, Lake Tahoe, California, USA, June 7-9, 2006, ISBN 1-59593-353-0.
- E. Bertino, L. Khan, R. Sandhu, and B. Thuraisingham, "Secure Knowledge Management: Confidentiality, Trust, and Privacy," to appear in *IEEE Transactions on Systems, Man and Cybernetics, Part A*.
- F. Luo, L. Khan , F. Bastani, I-Ling Yen and J. Zhou, “A Dynamical Growing Self-Organizing Tree (DGSOT) for Hierarchical Clustering Gene Expression Profiles,” *Bioinformatics Journal*, 20 (16): 2605-2617 (2004), Oxford University Press, UK.
- L. Khan and D. McLeod, “Audio Structuring and Personalized Retrieval Using Ontologies,” in *Proc. of ACM/IEEE Advances in Digital Libraries, Library of Congress*, Washington, DC, pp. 116-126, May 2000.
- L. Khan, D. McLeod, E. Hovy, “A Framework for Effective Annotation of Information from Closed Captions Using Ontologies” *The Journal of Intelligent Information Systems (JIIS)*, Kluwer Academic Publishers, Vol. 25, No. 2 Page 181-205.
- L.Wang, L. Khan, and B.Thuraisingham, “A Framework for Automated Image Annotation,” To appear in *International Journal of Computer Systems Science and Engineering*, CRL Publishing LTD, United Kingdom

Advisor: Dennis McLeod, Computer Science, University of Southern California.

Advisee:

Ph.D.: A. Abedin, M. Masud, S. Nessa, J. Yundt-Pacheco (part time), M. Richard (part time), and L. Wang.

Graduated: F. Luo (Ph.D. –Summer 2004, Currently Assistant Professor at Clemson University), M. Awad (Ph.D. – Fall 2005, Currently Assistant Professor at UAE), A. Bashir (M.S. thesis), K. Golnabi (M.S. thesis), Manish Gupta (M.S. thesis), M. Mirza (M.S. thesis), C. Breen (M.S.), R. Bhairampally (M.S.), and Y. Rao (M.S.).