Microsoft Research

Microsoft Academic Graph

Alex Wade
Microsoft Research

Microsoft

@alexwade

SIGIR2015
SANTIAGO - CHILE

Microsoft Academic Graph

- Background
- Bing / Cortana
- The Data
- The Challenge (WSDM Cup)

Microsoft Academic Graph

- Background
  - Project Libra (2005 – 2008) Wei-Ying Ma, et al.
  - Microsoft Academic Search (2008 – 2012)
  - → Bing, Cortana (2015 –)
- Bing examples
- The Data
- The Challenge (WSDM Cup)

	Papers	Citations	Authors
Libra	~5M	~20M	~1M
MAS	~50M	~350M	~20M
Bing	~125M	~1B	~40M

SIGIR2015
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Microsoft Academic Search Beta

Fields of Study

Advanced Search

All Fields of Study
Computer Science
Algorithms & Theory
Artificial Intelligence
Bioinformatics & Computational Biology
Computer Education
Computer Vision
Data Mining
Databases
Human-Computer Interaction
Information Retrieval
Machine Learning & Pattern Recognition
Interaction
Information Retrieval
Machine Learning

Authors Publications Conferences Journals Keywords Organizations

Top auth






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Introdu
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Authors Publications Conferences Journals Keywords Organizations

Top conferences in information retrieval

SIGIR - Research and Development in Inform...
CIKM - International Conference on Informa...
TREC - Text REtrieval Conference
JCDL - ACM/IEEE Joint Conference on Digita...
DL - Digital Libraries
ECDL - European Conference on Digital Libr...
CLEF - Cross-Language Evaluation Forum
RIAO - Recherche d'Information Assistee pa...
ECIR - European Colloquium on IR Research
Multimedia Information Retrieval

See more

Authors (3516)

W. Bruce Croft
Jamie Callan
James Allan
Cheng-xiang Zhai
Norbert Fuhr
Mark Sanderson
Susan T. Dumais
Justin Zobel
Alistair Moffat
Ryen W. White

Keywords (2238)

Document Retrieval **Indexation** Information Need **Information Retrieval System** **Information Retrieval** Language Model Machine Learning Query Expansion Question Answering Relevance Feedback **Search Engine** **Test Collection** Text Retrieval Web Pages **Web Search**

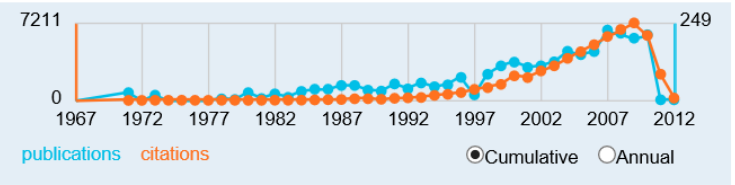
SIGIR - Research and Development in Information Retrieval

Publications: 2,717 | Citation Count: 72,105 (Self-Citation: 5,483)

Year Range: 1971-2012

Fields of study: Information Retrieval

Homepage



Publications (2717)

Sort by: Year

[Improving tweet stream classification by detecting changes in word probability]
Kyosuke Nishida, Takahide Hoshide, Ko Fujimura
Conference: Research and Development in Information Retrieval - SIGIR, pp. 971-980, 2012

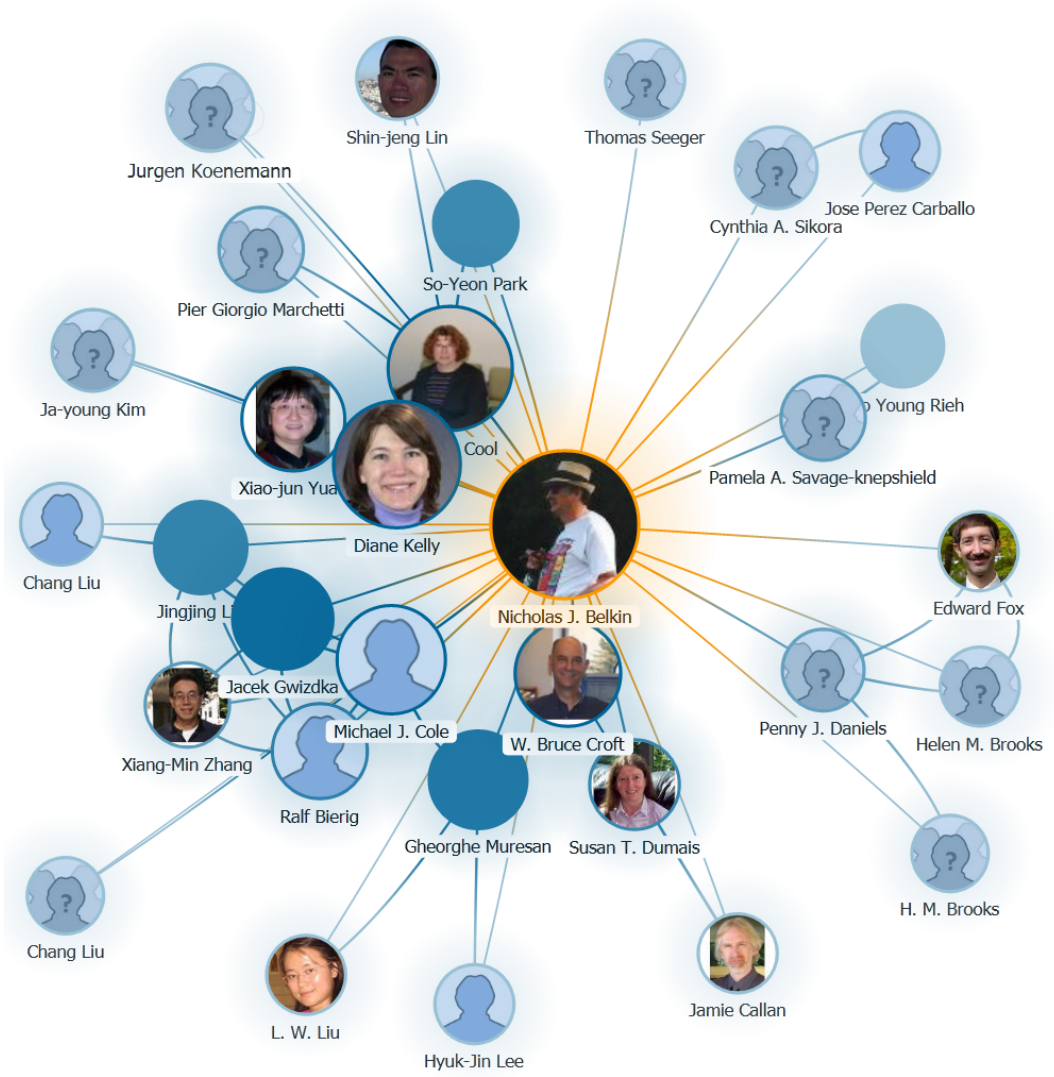
[Combining implicit and explicit topic representations for result diversification]
Jiyin He, Vera Hollink, Arjen de Vries
Conference: Research and Development in Information Retrieval - SIGIR, pp. 851-860, 2012

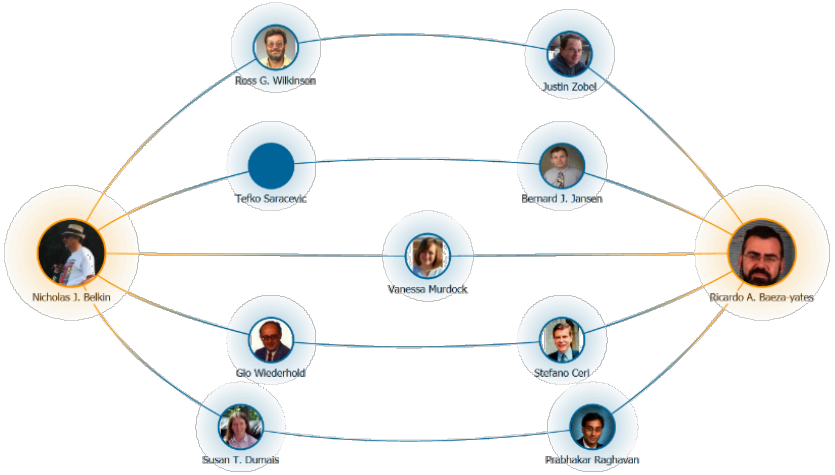
[Personalized social query expansion using social bookmarking systems]
Mohamed Reda Bouadjenek, Hakim Hacid, Mokrane Bouzeghoub, Johann Daigremont
Conference: Research and Development in Information Retrieval - SIGIR, pp. 1113-1114, 2011

[Evaluating the Synergic Effect of Collaboration in Information Seeking]
Chirag Shah, Roberto Gonzalez-Ibanez
Conference: Research and Development in Information Retrieval - SIGIR, pp. 913-922, 2011

[Jester 2.0 : Evaluation of a New Linear Time Collaborative Filtering Algorithm] (Citations: 10)
Mark Digiovanni, Hiro Narita, Ken Goldberg
Conference: Research and Development in Information Retrieval - SIGIR, 2010

Published in 2012.


Jurgen Koenemann
Shin-jeng Lin
Thomas Seeger
Cynthia A. Sikora
Jose Perez Carballo
So-Yeon Park
Pier Giorgio Marchetti
Ja-young Kim
Xiao-jun Yua
Cool
Diane Kelly
Young Rieh
Pamela A. Savage-knepshield
Chang Liu
Jingjing L
Nicholas J. Belkin
Edward Fox
Jacek Gwizdka
Michael J. Cole
W. Bruce Croft
Penny J. Daniels
Helen M. Brooks
Xiang-Min Zhang
Ralf Bierig
Gheorghe Muresan
Susan T. Dumais
H. M. Brooks
Chang Liu
L. W. Liu
Hyuk-Jin Lee
Jamie Callan


Ross G. Wilkinson
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Bernard J. Jansen
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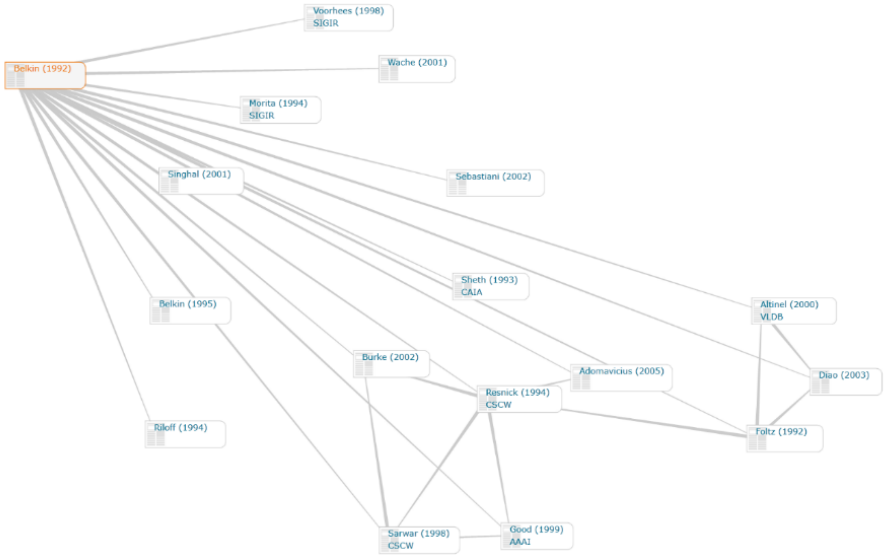
Voorhees (1998) SIGIR
Belkin (1992)
Wache (2001)
Morita (1994) SIGIR
Singhal (2001)
Sebastiani (2002)
Sheth (1993) CAIA
Belkin (1995)
Altinel (2000) VLDB
Burke (2002)
Adomavicius (2005)
Diao (2003)
Resnick (1994) CSCW
Riloff (1994)
Foltz (1992)
Sarwar (1998) CSCW
Good (1999) AAAI

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- Get the Data
- WSDM Cup

An Overview of Microsoft Academic Service (MAS) and Applications

Arnab Sinha, Zhihong Shen, Yang Song, Hao Ma, Darrin Eide, Bo-june (Paul) Hsu, Kuansan Wang
Microsoft Research, Redmond, WA 98052, USA
{arsinha, zhihosh, yangsong, haoma, darrine, paulhsu, kuansanw}@microsoft.com

ABSTRACT

In this paper we describe a new release of a Web scale entity graph that serves as the backbone of Microsoft Academic Service (MAS), a major production effort with a broadened scope to the namesake vertical search engine that has been publicly available since 2008 as a research prototype. At the core of MAS is a heterogeneous entity graph comprised of six types of entities that model the scholarly activities: field of study, author, institution, paper, venue, and event. In addition to obtaining these entities from the publisher feeds as in the previous effort, we in this version include data mining results from the Web index and an in-house knowledge base from Bing, a major commercial search engine. As a result of the Bing integration, the new MAS graph sees significant increase in size, with fresh information streaming in automatically following their discoveries by the search engine. In addition, the rich entity relations included in the knowledge base provide additional signals to disambiguate and enrich the entities within and beyond the academic domain. The number of papers indexed by MAS, for instance, has grown from low tens of millions to 83 million while maintaining an above 95% accuracy based on test data sets derived from academic activities at Microsoft Research. Based on the data set, we demonstrate two scenarios in this work: a knowledge driven, highly interactive dialog that seamlessly combines reactive search and proactive suggestion experience, and a proactive heterogeneous entity recommendation.

Keywords

Academic search; Recommender systems; Entity conflation

1. INTRODUCTION

Recent years have witnessed a paradigm shift in how the knowledge on the Web is made available to the users. The trend is highly visible in the evolution of the Web search engine. The traditional Web search outcomes often serve the users' need at best in a "hit-or-miss" fashion [4, 7]. A multi-year initiative in the industry, called Bing Dialog in Microsoft [11] and Knowledge Vault in Google [5], addresses this challenge by using statistical inferences to better organize the Web information and support much richer forms of interaction in recognizing and serving the user needs. In addition to reactively retrieving information and answering questions, the model proactively includes additional dialog acts, such as confirmation, disambiguation, refinement and digression. Coupled with statistical user intent inferences, these acts significantly expedite the process of serving users with the knowledge they need [14]. Our work aims at leveraging this model in addressing the information needs in areas where the sheer amount of information available through a multitude of channels has exceeded the human capacity in processing them. Although most search engines have provided advanced operators for users to compose elaborated queries to better filter out unwanted materials, their arcane syntax has relegated their usages to a negligible rate. A goal of the modern dialog approach to Web search is therefore to utilize advanced techniques to enable the search engines to communicate with users in natural language. Because the dialog inferences inevitably require the system to anticipate or predict the needs of the users, another emerging trend in the search engine evolution is to extend the prediction behaviors into system initiated notifications. The growing prevalence of mobile personal assistants serve as a natural vehicle to deliver proactive notifications, potentially preempting the needs of user initiated search for information [10].

In this paper, we present two applications in the area of academic publications to demonstrate the potentials of the emerging search paradigm. The first application, described in Section 3.1, illustrates a natural language powered interactive search experience. By leveraging the relationships among the entities in the academic domain, the natural language processor is able to harvest the syntactic and semantic cues for parsing and predicting user queries. The second application, described in Section 3.2, demonstrates how a recommendation system can take advantage of the relationships across different types of entities to offer heterogeneous suggestions. Noting that the statistical techniques underlying these two applications are by no means perfect, we further decide to make the data used by the two applications publicly available so that the community can jointly attack the challenging unsolved problems. The data set is an update to the corpus previously released for research purposes [2] and will be described in details in Section 2. The two applications also exemplify a commonly encountered scenario in which the results presented to the users should be properly ranked. The ranking algorithms and the measurements for determining the ranking order remain actively research topics. Given the surge in the count of academic entities and observable limitations of citation count based impact metrics, the problem of defining meaningful impact metrics of academic entities (e.g. papers, authors, conferences) is gaining substantial interest among the researchers [8, 3]. We hope this open corpus can contribute not only to advance information technologies for other innovative applications but also trigger a new horizon of

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ACM 978-1-4503-3473-0/15/05.
http://dx.doi.org/10.1145/2740908.2742839.

http://aka.ms/academicgraph

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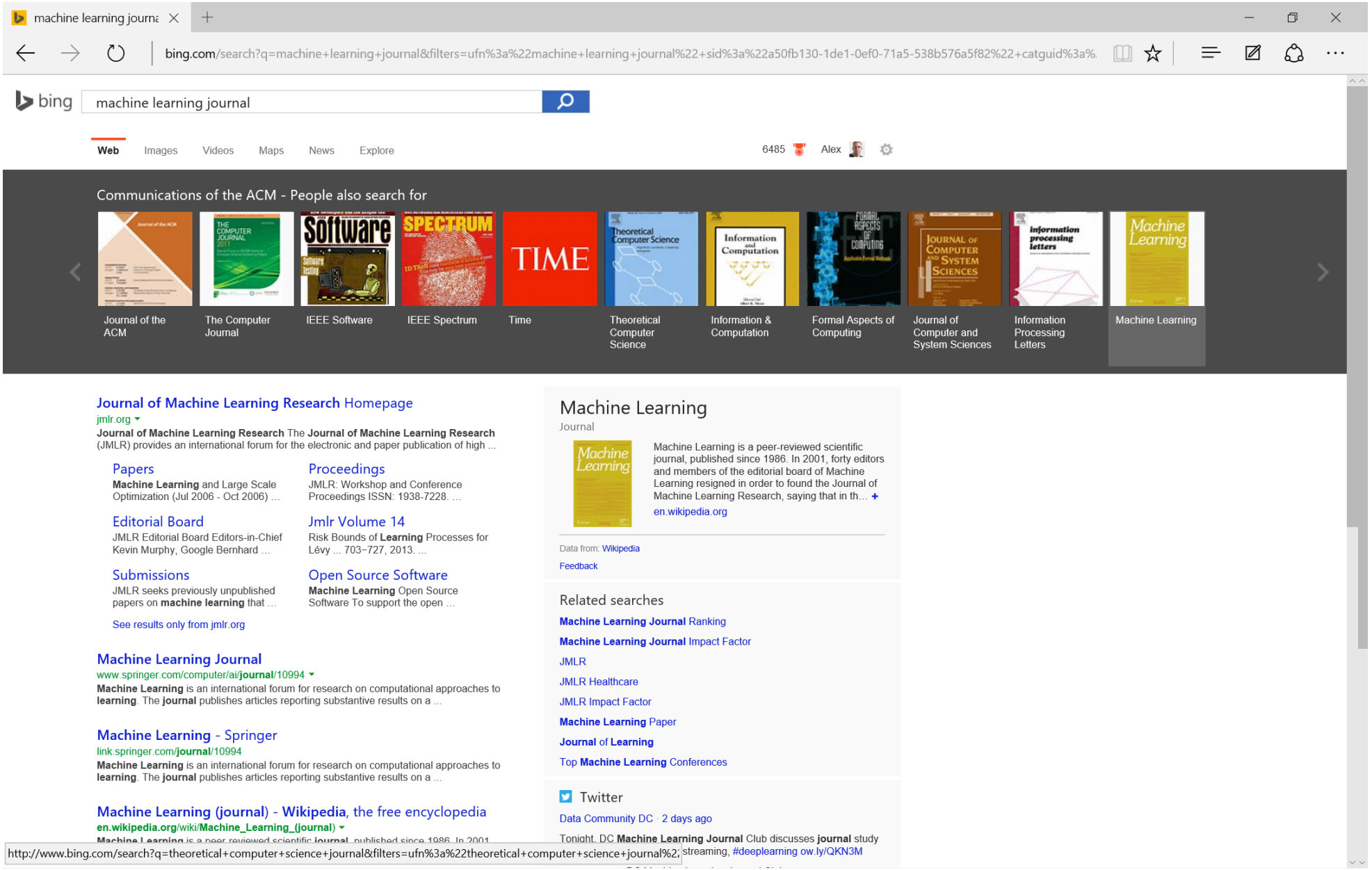
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michael i. jordan - Bing

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Andrew Ng - People also search for

Daphne Koller | Michael I. Jordan, Academic Advisor | Geoffrey Hinton | Ray Kurzweil | Sebastian Thrun | Raj Reddy | Stuart J. Russell | Dan Boneh | Jeffrey Ullman | Peter Norvig | Mehran Sahami | Donald Knuth

Connection to Andrew Ng

Michael I. Jordan and Andrew Ng both wrote Latent dirichlet allocation.

Michael I. Jordan's Home Page
www.cs.berkeley.edu/~**jordan**
Michael I. Jordan Pehong Chen Distinguished Professor Department of EECS Department of Statistics University of California, Berkeley. Emails: EECS Address:
Publications · Yuchen Zhang · Martin Wainwright · Andre Wibisono · Ashia Wilson

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Michael Jeffrey **Jordan** (born February 17, 1963), also known by his initials, MJ, is an American former professional basketball player. He is also an entrepreneur, and ...
Early years · High school · College · Professional career · Olympic career

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Michael I. Jordan - Wikipedia, the free encyclopedia
en.wikipedia.org/wiki/**Michael_I._Jordan**
Michael Irwin **Jordan** (born 1956) is an American scientist, Professor at the University of

Michael I. Jordan

Scientist

Michael Irwin Jordan is an American scientist, Professor at the University of California, Berkeley and leading researcher in machine learning and artificial intelligence. Jordan was born in Ponchatoula, Louisiana, to a working-class fa... +

Wikipedia

Born: Feb 25, 1956 (age 59) · Louisiana, United States, with Territories

Education: Arizona State University · University of California, San Diego

Academic advisor: David Rumelhart

Written works: Probabilistic Grammars and Hierarchical Dirichlet Processes · Hierarchical Dirichlet Processes · Latent dirichlet allocation

Timeline

1988: He was a professor at MIT from 1988-1998.

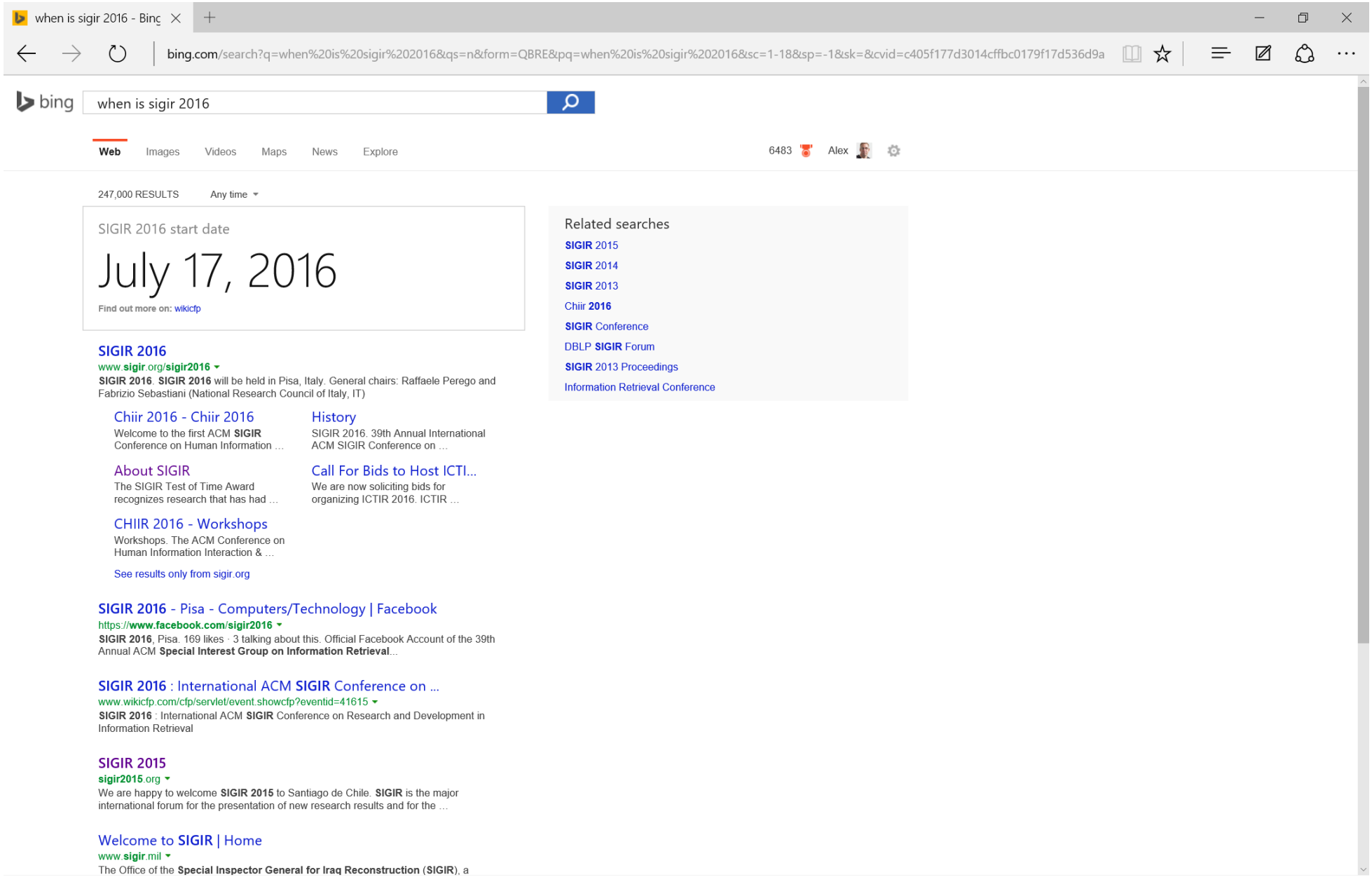
1991: Adaptive mixtures of local experts written by Michael I. Jordan was first published in 1991.

2003: Latent dirichlet allocation written by Michael I. Jordan was first published on March 01, 2003.

See more

Data from: Wikipedia · Microsoft · Berkeley · Freebase

Feedback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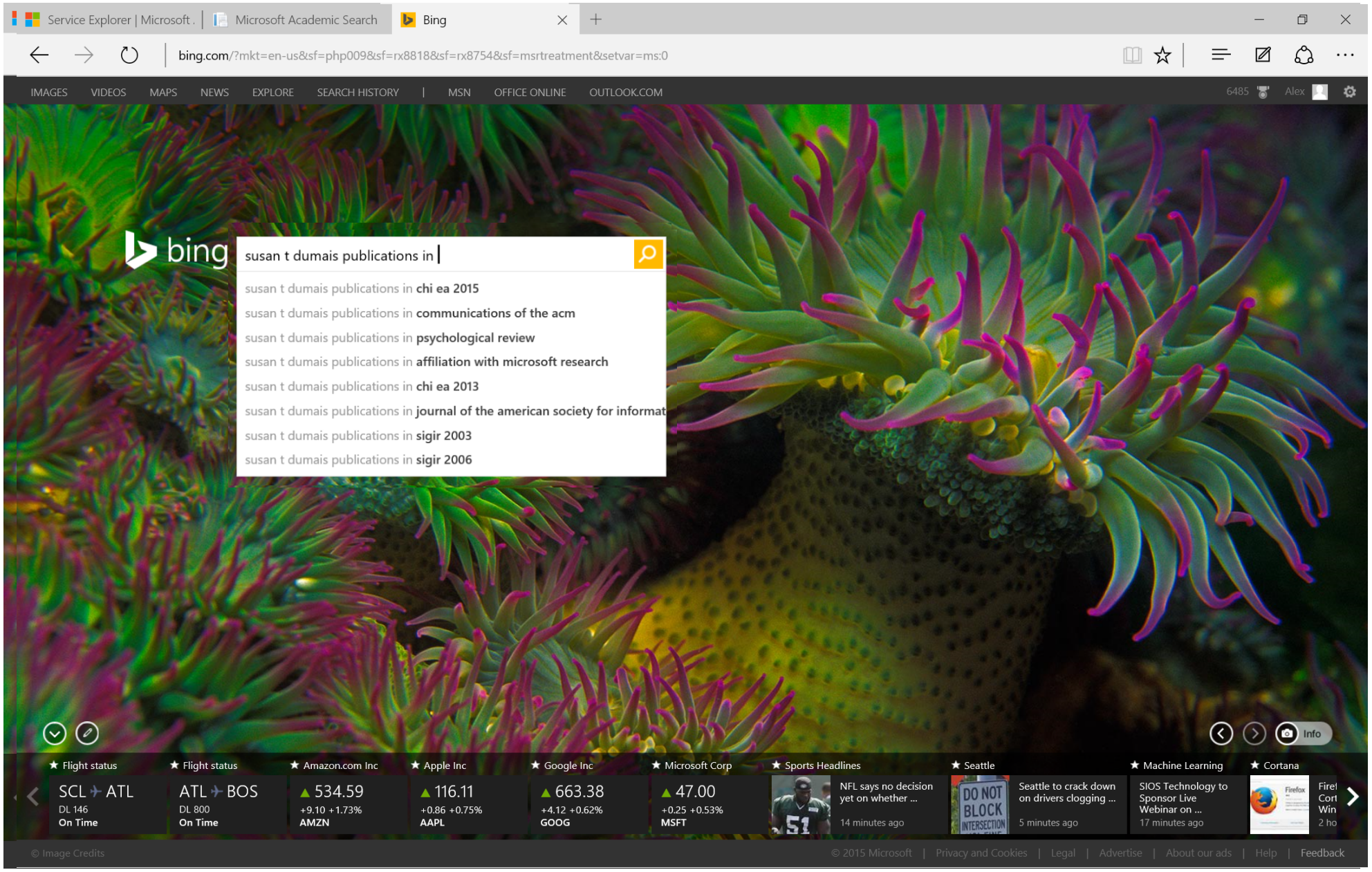
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Microsoft Academic Search
Bing
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Info
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DL 146
On Time
★ Flight status
ATL ✈ BOS
DL 800
On Time
★ Amazon.com Inc
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+9.10 +1.73%
AMZN
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★ Google Inc
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GOOG
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▲ 47.00
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★ Cortana
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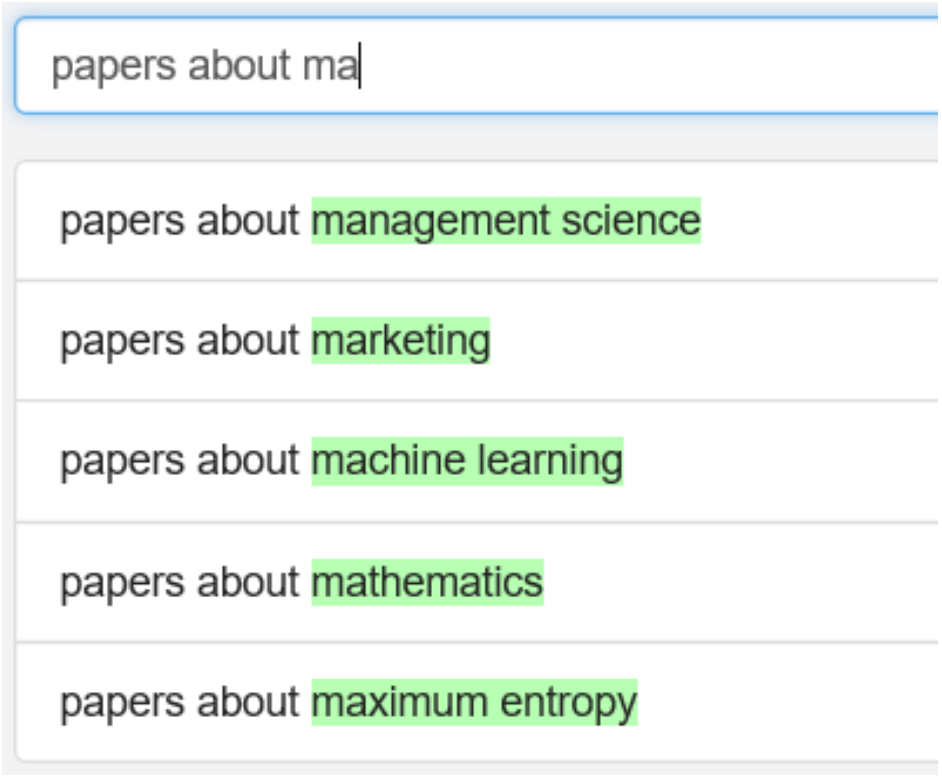
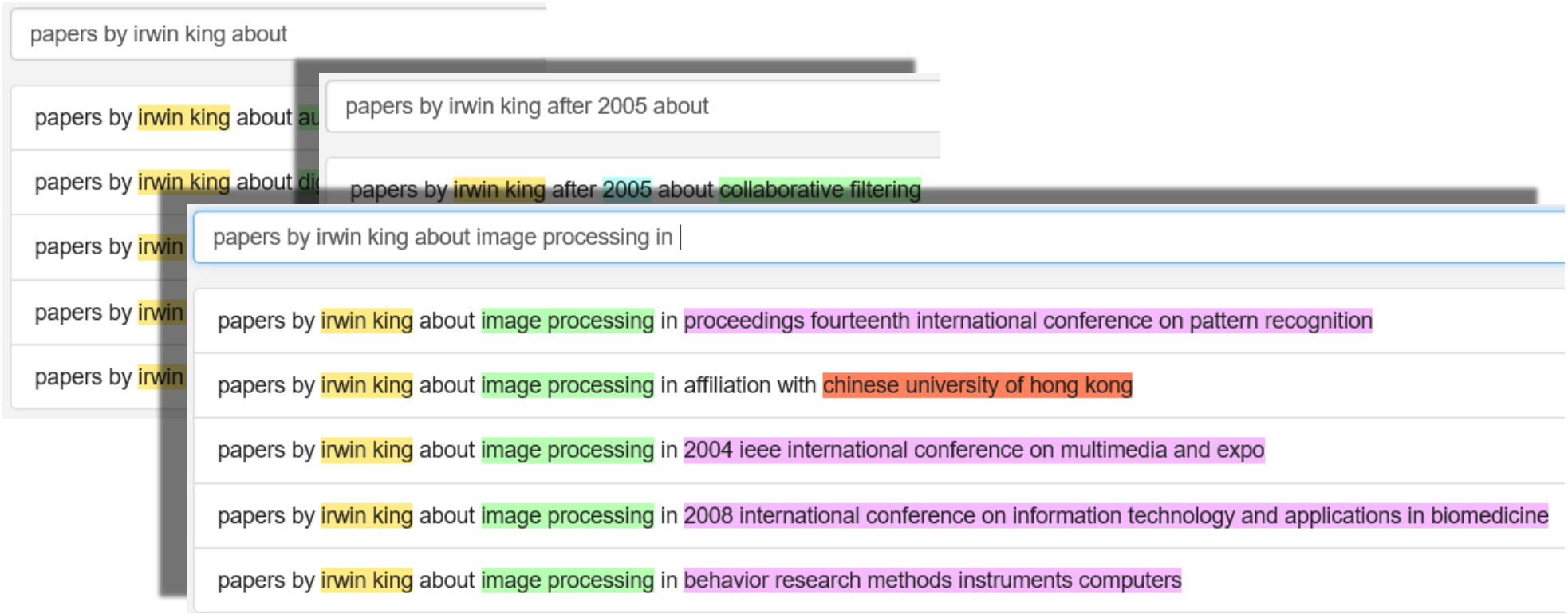
NL Query Completion/Recommendation

- How to complete never foreseen academic queries?
- How to rank completion suggestions?
- How to avoid making completions leading no search results?



Finding reviewers/co-PI made easier



Understanding a colleague made easier

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Bing	~125M	~1B	~40M

	Papers	Citations	Authors
Microsoft Academic	~40M	~250M	~20M
Microsoft Academic Graph	~100M	~700M	~25M

Data Releases

- Microsoft Academic (2012) - https://datamarket.azure.com/dataset/mrc/microsoftacademic
  - Azure Datamarket
  - REST API

- Microsoft Academic Graph (2015) - http://aka.ms/academicgraph
  - Increased coverage
  - Azure blob storage
  - No API (yet!)
  - Improved topic classification
  - More current (→ early 2015)

	Papers	Citations	Authors
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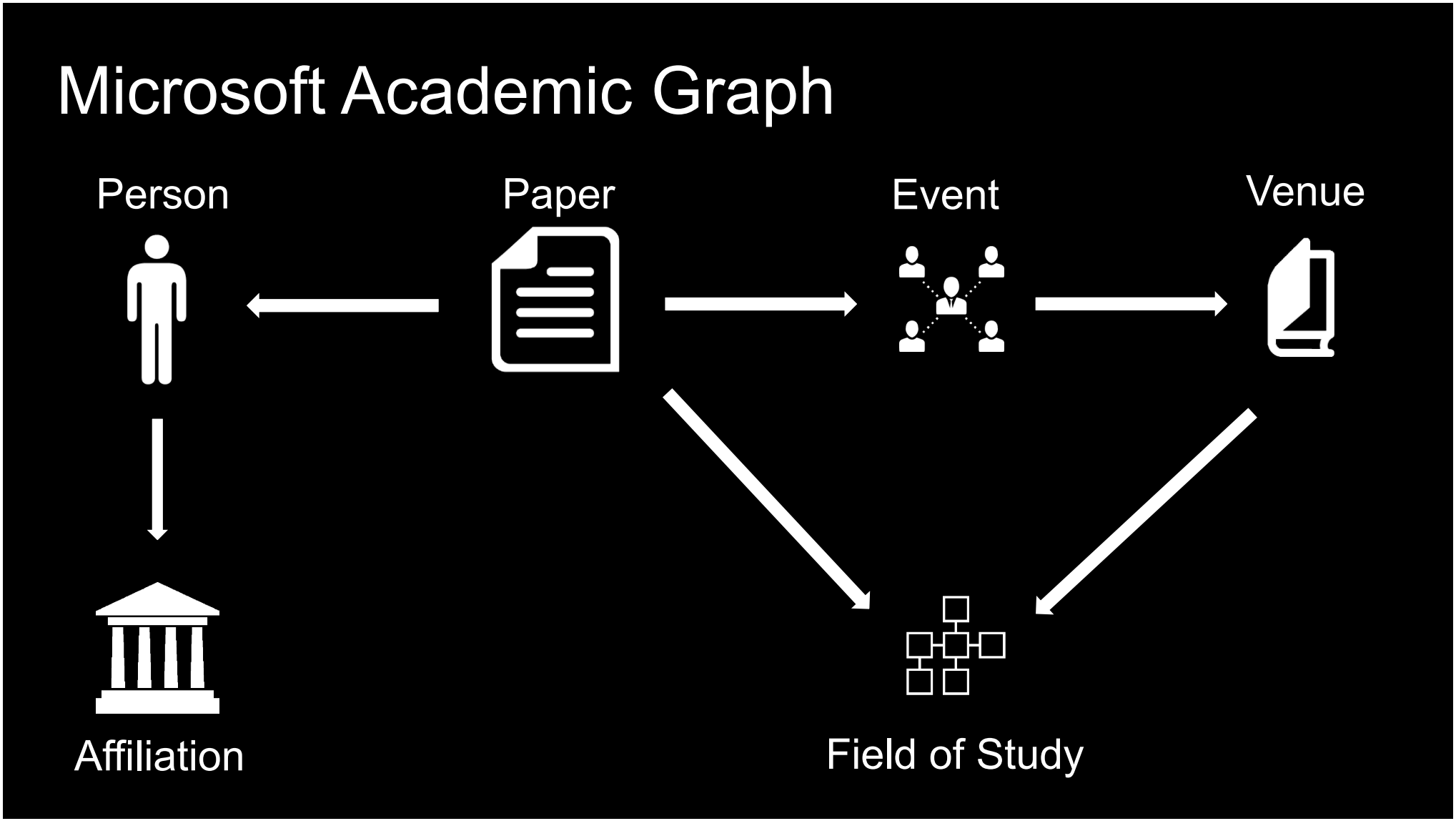
Microsoft Academic Graph	~100M	~700M	~25M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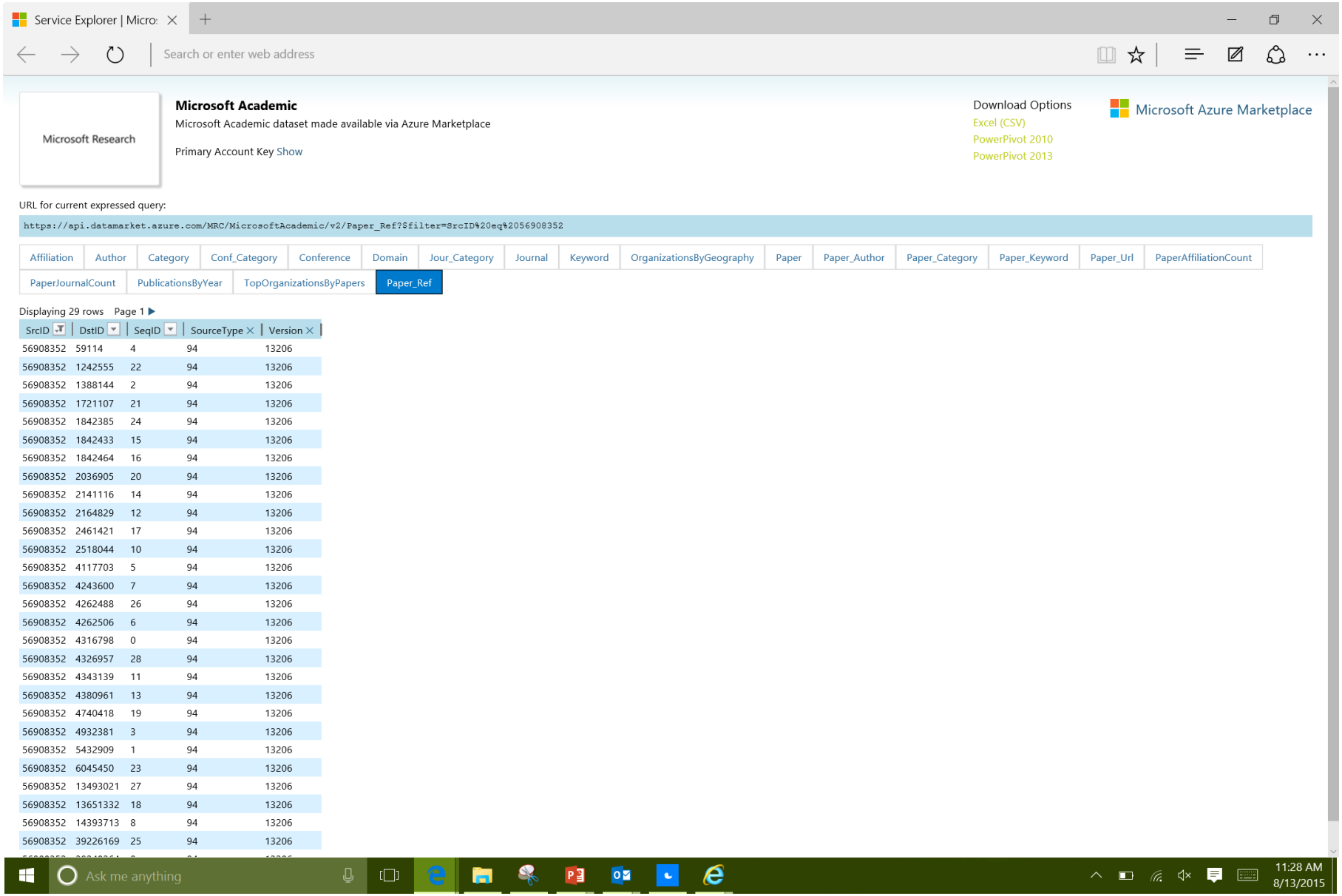
Paper
Event
Venue
Affiliation
Field of Study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PowerPivot 2013
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URL for current expressed query:
https://api.datamarket.azure.com/MRC/MicrosoftAcademic/v2/Paper_Ref?$filter=SrcID%20eq%2056908352
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Conf_Category
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Domain
Jour_Category
Journal
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OrganizationsByGeography
Paper
Paper_Author
Paper_Category
Paper_Keyword
Paper_Url
PaperAffiliationCount
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Microsoft Academic Graph

The Microsoft Academic Graph is a heterogeneous graph containing scientific publication records, citation relationships between those publications, as well as authors, institutions, journals and conference "venues" and fields of study. This data is available as a set of zipped text files stored in Microsoft Azure blob storage and available via HTTP. The file size is ~37GB.

We encourage researchers working with this data to apply for an Azure for Research Award. Details are available on the Azure for Research award submission process at http://azure4research.com. Please include the hashtag #academicgraph in your submission title for easier tracking.

To download the data you need to first agree to the terms of use.

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Please note: in order to emphasize one important technical challenge that is common in web-scale data collection and aggregation, the data released here have undergone only rudimentary processing, for example in areas of author and paper conflation/deduplication. This noisy yet realistic dataset can provide additional avenues for research in the big data arena.

We kindly request that any published research that makes use of this data cites our data paper listed below.

Publications

- Arnab Sinha, Zhihong Shen, Yang Song, Hao Ma, Darrin Eide, and Kuansan Wang, An Overview of Microsoft Academic Service (MAS) and Applications, WWW – World Wide Web Consortium (W3C), 18 May 2015.

http://aka.ms/academicgraph

Microsoft Academic Graph

- Background
  - Project Libra (2005 – 2008) Wei-Ying Ma, et al.
  - Microsoft Academic Search (2008 – 2012)
  - → Bing, Cortana (2015 –)
- Bing examples
- The Data
- The Challenge (WSDM Cup)

	Papers	Citations	Authors
Libra	~5M	~20M	~1M
MAS	~50M	~350M	~20M
Bing	~125M	~1B	~40M

	Papers	Citations	Authors
Microsoft Academic	~40M	~250M	~20M
Microsoft Academic Graph	~100M	~700M	~25M

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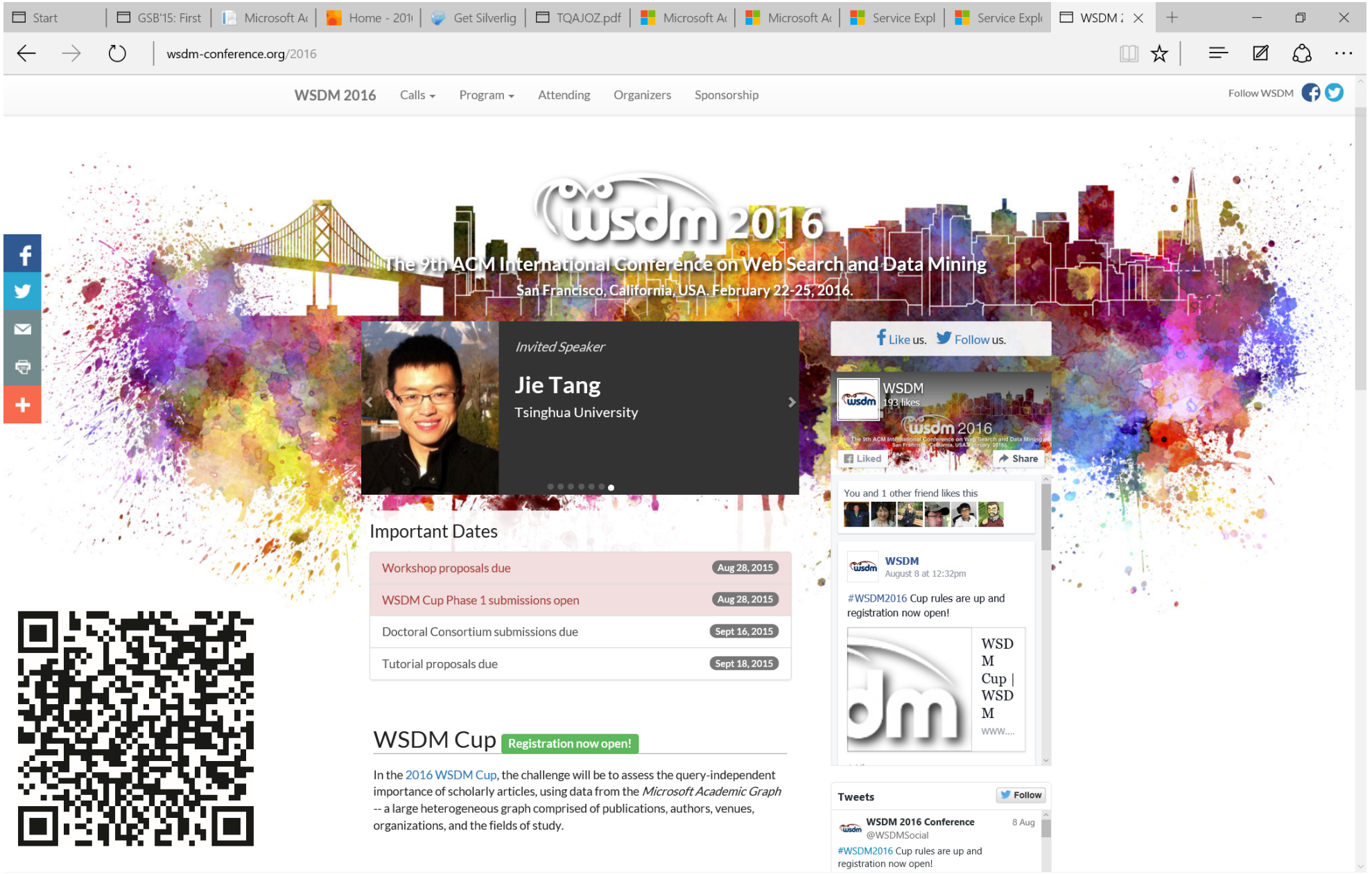
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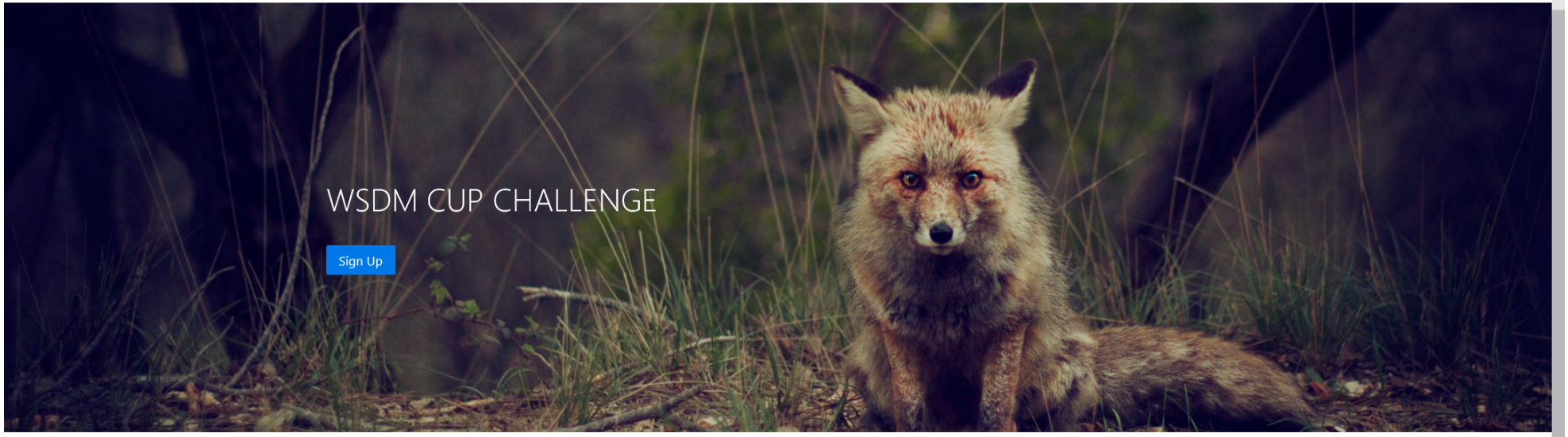

The Graph

The Microsoft Academic Graph is a heterogeneous graph containing scientific publication records, citation relationships between publications, as well as authors, institutions, journal and conference "venues," and fields of study.

The Data

This data is available as a set of zipped text files stored in Microsoft Azure blob storage and available via HTTP. The file size (zipped) is ~37GB. The data provided for the challenge may be access and downloaded here.

The Challenge

The goal of the Ranker Challenge is to assess the query-independent importance of scholarly articles, using data from the Microsoft Academic Graph--a large heterogeneous graph comprised of publications, authors, venues, organizations, and the fields of study.

Azure For Research

We encourage researchers working with this data to apply for an Azure for Research Award. Details are available on the Azure for Research award submission process at http://azure4research.com. Please include the hashtag #academicgraph in your submission title for easier tracking.

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Questions?

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