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Text Technologies for Data Science

INFR11145

Introduction

Instructor:
Walid Magdy

19-Sep-2017

Lecture Objectives

- Know about the course:
  - Topic
  - Objectives
  - Format
  - Requirements
  - Logistics
- Have a decision on the course
  - Stay
  - Run away

Text Technologies for Data Science

= documents, words, terms, …

≠ images, videos, music *(with no text)*

Information Retrieval

Information Filtering

Text Classification

Search Engines Technologies

What is Information Retrieval (IR)?

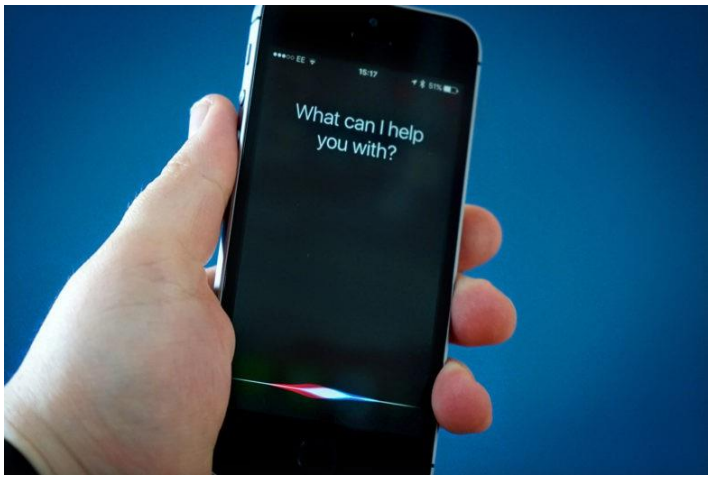
IR is NOT just

Google

Google Search I'm Feeling Lucky

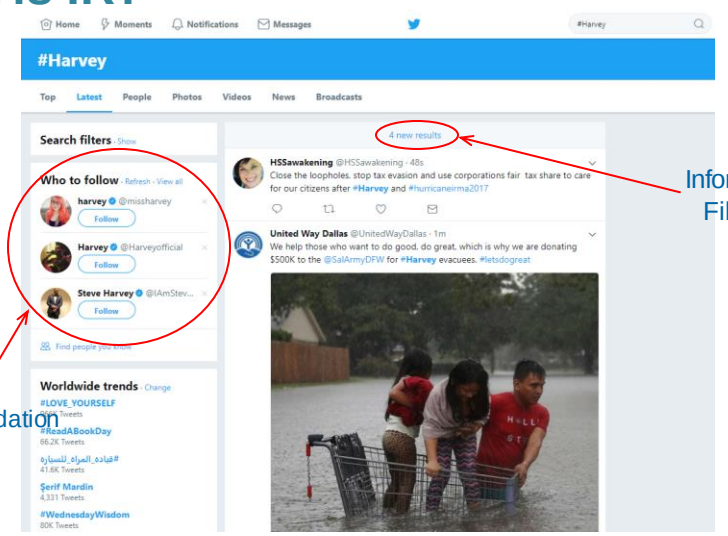
Web search

What is IR?



Speech - QA

What is IR?



Information Filtering

Recommendation

Social search

What is IR?


DON ANTONIO LOPEZ

Library (book) search

1950's

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What is IR?

Legal search

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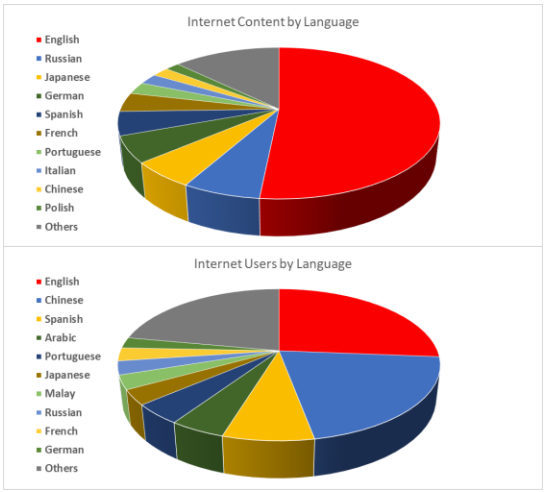
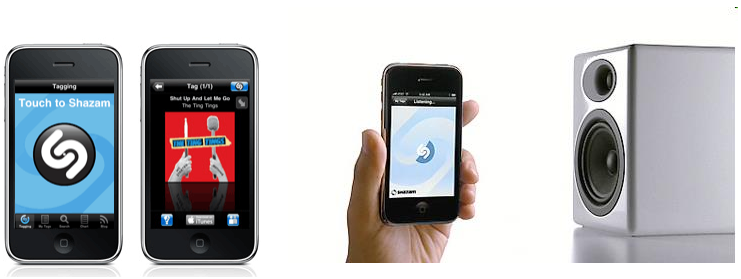
What is IR?



Cross-Language search

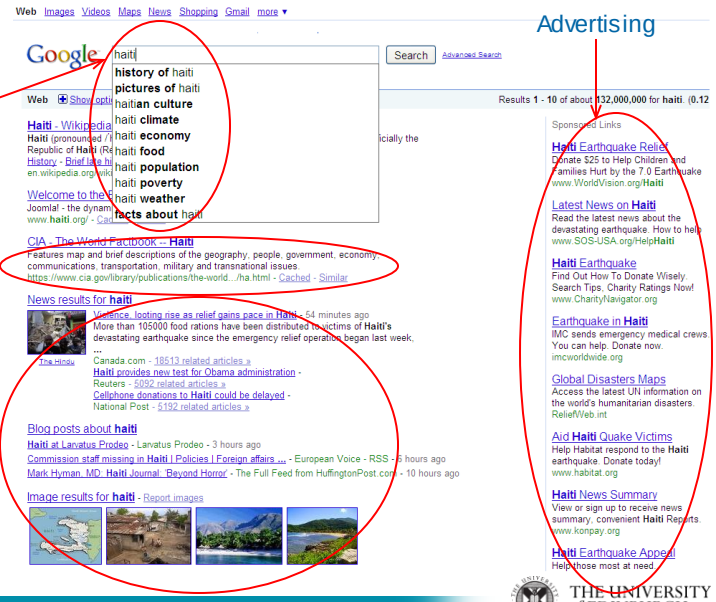
What is IR?



Content-based music search

*Source: Matt Lease (IR Course at U Texas)

What is IR?



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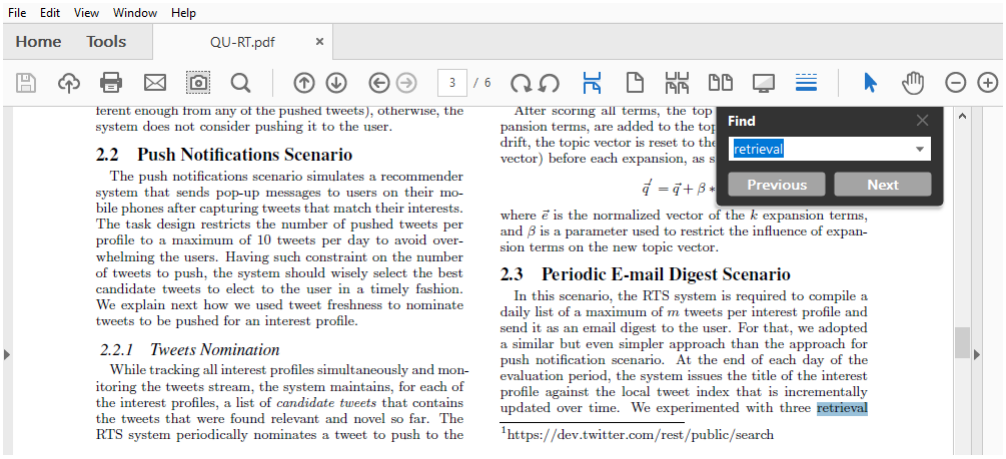
What is IR? Find?



IR ≠ Find

- Sequential
- Exact match

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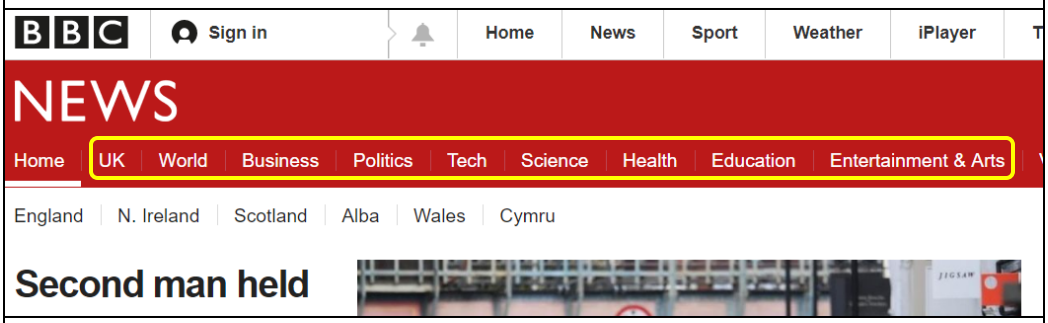
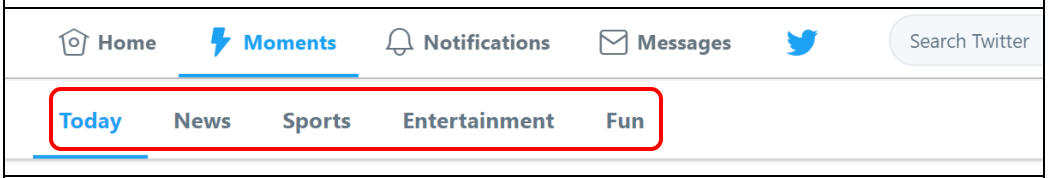
What is IR?

- **IR** is finding material of an unstructured nature that satisfies an information need from within large collections

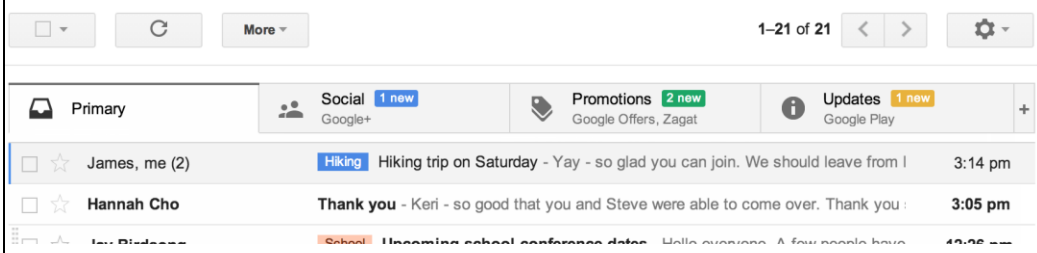
- Find → Task
- Unstructured → Nature
- Information need → Target
- Satisfies → Evaluation

Text classification





Text classification



Text classification

US008881191B2

(12) **United States Patent**
Magdy et al.

(10) **Patent No.: US 8,881,191 B2**
(45) **Date of Patent: Nov. 4, 2014**

(54) **PERSONALIZED EVENT NOTIFICATION USING REAL-TIME VIDEO ANALYSIS**

(75) Inventors: **Walid Magdy**, Giza (EG); **Motaz El-Saban**, Giza (EG)

(73) Assignee: **Microsoft Corporation**, Redmond, WA (US)

(*) Notice: Subject to any disclaimer, the term of this

(51) **Int. Cl.**
H04H 60/65 (2008.01)
H04H 60/48 (2008.01)
G06F 17/30 (2006.01)

(52) **U.S. Cl.**
CPC ***H04H 60/48*** (2013.01); ***H04H 60/65*** (2013.01); ***G06F 17/30787*** (2013.01); ***G06F 17/30831*** (2013.01)
USPC **725/32**; 725/43; 725/52; 382/181; 348/460

What is text classification?

- **Text classification** is the process of classifying documents into predefined categories based on their content.

- Input: Text (document, article, sentence)
- Task: Classify into one/multiple categories
- Categories:
  - Binary: relevant/irrelevant, spam .. etc.
  - Few: sports/politics/comedy/technology
  - Hierarchical: patents

In this course, we will learn

- How to build a search engine
  - which search results to rank at the top
  - how to do it fast and on a massive scale
- How to evaluate a search algorithm
  - is system A really better than system B
- How to work with text
  - two tweets talk about the same topic?
  - handle misspellings, morphology, synonyms
- How to classify text
  - into relevant/non-relevant (filtering)
  - into categories (sports, news, comedy, …)
  - features to use
  - classification methods to use

This course overlaps a bit with

- ANLP, FNLP
  - Some text processing
  - Text laws
  - No NLP (word/phrase level vs document level)
- ML practical
  - Text classification
  - No ML (using off-the-shelf ML tool)
- It does not overlap with others on:
  - Search engines
  - IR methods/models
  - IR evaluation

Some terms you will learn about

- Inverted index
- Vector space model
- Retrieval models: TFIDF, BM25, LM
- Page rank
- Learning to rank (L2R)
- MAP, MRR, nDCG
- Mutual information, information gain
- SVMs: binary/multiclass classification, ranking, regression

Skills to be gained

- Working with large text collections
- Few shell commands
- Some Perl programming
- IR tools: Lemur / Indri / Solr
- Crawling: Web / Tweets
- TEAM WORK

Course Structure

- 18 Lectures:
  - 2 lectures → Introduction
  - 10 lectures → IR
  - 2 lectures → Applications
  - 2 lectures → Text Classification
- 8-10 Labs:
  - Practice what you learn
- No Tutorials
- Much self-reading + system implementation
- Few online videos

Assessments

- Assignment 1: 10%
- Assignment 2: 10%
- Group project: 20%
- Final Exam: 60%

- $Mark_{project} = 0.5\ Mark_{team} + 0.5\ Mark_{individual}$
- Final exam: 2nd semester

Good to know

- Course has not been taught for two years
- New instructor
- Updated content
- Updated credit (previously 10, now 20) → 200 hours
- Additional credit is directed mainly to practical work
- Previous versions average mark: 52%

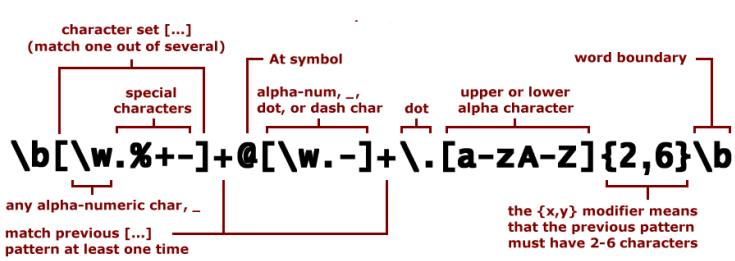
Pre-requests (1/3)

- Maths requirements:
  - Linear algebra: vectors/matrices (addition, multiplication, inverse, projections ... etc).
  - Probability theory: Discrete and continuous univariate random variables. Bayes rule. Expectation, variance. Univariate Gaussian distribution.
  - Calculus: Functions of several variables. Partial differentiation. Multivariate maxima and minima.
  - Special functions: Log, Exp, Ln.

$$\text{BM25}(D,Q) = \sum_{i=1}^{n} \log \frac{N - n(q_i) + 0.5}{n(q_i) + 0.5} \cdot \left[\frac{f(q_i, D) \cdot (k_1 + 1)}{f(q_i, D) + k_1 \cdot \left(1 - b + b \cdot \frac{|D|}{\text{avgdl}}\right)} + \delta \right]$$

Pre-requests (2/3)

- Programming requirements:
  - Python and/or Perl, and good knowledge in regular expressions
  - Shell commands (cat, sort, grep, uniq, sed, ...)
  - Additional programming language could be useful for course project.



Parse: username@domain.TLD (top level domain)

Pre-requests (3/3)

- Team-work requirement:
  - Final course project would be in groups of 4-6 students. Working in a team for the project is a requirement.

Logistics (1/2)

- Course webpage: http://www.inf.ed.ac.uk/teaching/courses/tts/
- Lectures:
  - 2 Lectures on the same day (30mins break in-between)
  - Tuesdays, 14.00-16.30
  - Lecture Theatre A, David Hume Tower
- Practical labs:
  - Thursdays, 12.10-13.00 & 16.10-17.00
  - Room 6.06, Appleton Tower
- Demonstrator: Clara Vania

Logistics (2/2)

- Material: TBA with each lecture
- Assignments/Project: TBA
- Textbooks:
  - "Introduction to Information Retrieval". Manning et al.
  - "Search Engines: Information Retrieval in Practice"
- Discussion forum: https://piazza.com/class/j766gisdu46m

Questions

- Next lecture:
  Definitions of IR main concepts
  (more introduction)

Break
&
continue in 30 mins