



# MULTIMEDIA RETRIEVAL



THE UNIVERSITY OF  
SYDNEY

Week13

Course Review

# Course Review



- Course Summary
- Exam Preparation

# Course Content

- Multimedia Basics
- Multimedia Retrieval
  - Information Retrieval basics
    - Data representation, Similarity measurement, ...
    - Web Search
  - Multimedia Retrieval basics
    - Feature extraction, indexing, ...
  - Advanced topics

# Multimedia Basics

- Digitization concept
  - Sampling
  - Quantization
  - Aliasing
- Digital image acquisition and Representation
- Digital video acquisition and representation
- Digital audio acquisition and representation
  - Waveform, frequency & spectrum

The content marked with (\*) are for understanding only.

# Retrieval Basics

- Information retrieval
  - Motivations, challenges, and general paradigm
  - Document preprocessing
    - parsing/tokenization
    - Stemming
    - Stop word removal
  - Indexing and index
  - Ranking
    - $TF * IDF$
    - Similarity Measurement
  - Relevance feedback
  - Query Expansion, Summarization, and visualization
  - Evaluation
- Web Search
  - Characteristics of Web
  - Paradigm of web search systems
  - Crawling
  - Ranking
    - PageRank: motivation and algorithm
    - HITS: motivation and algorithm

# Multimedia Retrieval Basics

- Content-based retrieval
  - Motivations and challenges
  - Issues
- Audio retrieval/classification
  - Features, applications
- Image retrieval
  - Feature extraction
    - Color: color space, techniques (color histogram, color moments, color coherence vector) and their properties
    - Texture: categorization, techniques and their properties (no calculating)
    - Shape: categorization, techniques and their properties (no calculating)
    - Spatial: 2D, 2D-G, 2D-C (\*)
    - Others features: Compressed domain, graph (\*)
    - Issues of feature extraction
  - Case studies

# Multimedia Retrieval Basics

- Other issues of CBR
  - ▣ Feature combination
    - Issues
    - Normalization: intra- & inter-
  - ▣ Similarity measure: distance functions and properties
  - ▣ Relevance feedback: concepts and techniques
  - ▣ Indexing: concepts, indexing techniques and their properties, issues
  - ▣ Performance evaluation
    - Metrics
    - Benchmark

# Multimedia Retrieval Basics

- Video retrieval
  - Access video content: fundamental aspects
    - Analysis, representation, browsing, retrieval
  - Segmentation
    - Shot detection
    - Key-frame extraction
    - Object segmentation
    - Scene/event detection
    - Story segmentation
    - Video abstract/skimming
  - Representation
    - Key-frame based
    - Shot-based: motion based, object based, ...
  - Applications
    - Video retrieval: by motion/trajectories
    - Video annotation: events in soccer video, dialogue detection, news video analysis
    - Video classification: movie genre classification, finding commercials in video



# Social Media

- Social multimedia
  - ▣ Attributes/properties
  - ▣ Applications
- User profile
- User context
- User interaction

# Large Scale Retrieval

- Semantic Gap
- Image/Video Annotation/Tagging
  - Co-occurrence approach
  - Translation approach
  - Classification approach
- Bag-of-Visual-Words model

# Recommender Systems

- Background
  - ▣ Recommendation algorithms
  - ▣ Collaborative filtering
    - User based
    - Model based
    - Matrix factorization
  - ▣ Content-based
    - Product, document, image, video, audio
  - ▣ Learning based
- Context Aware Recommendation
- Evaluation

# Summarization

- Text summarization
  - ▣ TextRank/LexRank
  
- Video summarization
  - ▣ Various categories of approaches
    - Strength and limitations
  
- Applications

# Conversational Retrieval

- Motivation of Conversational Retrieval
- Different parts of Conversational Retrieval
- Conventional Methods
- Deep Learning based Methods

# Exam Preparation

## □ Materials

- Lecture notes
  - Master core concepts and techniques
- Reference books, such as
  - Book 1: Chapter 1, 2, 3, 4, 5, 6, 8, 9, 18, 19, 20
  - Book 2: Chapter 1, 2, 4, 6, 7, 8, 19, 20, 21
- Tutorials



## □ Expectations

- To understand
  - Concepts, contents, and principles
- To be skilful
  - Practice algorithms/techniques with calculating
- To know
  - Solving problems
  - Analyzing results
  - Summarize ideas

# Sample (Sub)Questions

- Explain whether the indexing method employed in textual information retrieval can be similarly utilized for multimedia information retrieval. [6 marks]
- Consider a collection made of the following 4 documents d1, d2, d3, and d4 (one document per line in italic):
  - d1: *John gives a book to Mary*
  - d2: *John who reads a book loves Mary*
  - d3: *Who does John think Mary loves*
  - d4: *John thinks a book is a good gift*Perform a reasonable pre-processing (i.e. stop word removal and stemming) and build an index for these documents to support keyword based queries. [8 marks]
- Explain one issue with collaborative filtering. [3 marks]
- Consider the performance of following email anti-spam system against the ground truth. [3 marks]

We have a sample of 15 emails. The system reports that the following emails as spam: {1,4,7,8,11,13}, while the ground truth (labelled by human) denotes email {1,3,7,8,9,11,13,15} as spam. Calculate precision, recall and f-measure of the system
- Suppose now you have an album of photos on your mobile taken from different trips, including photos of yourself and other people, photos of food dishes, as well as scenic photos without people. Design a fully automatic system using what you have learned in this unit, to organize the photo album by putting related photos together. [8 marks]

Note that Metadata and Geo-data will not be available in this case; your system should only consider the visual information in the photos.

# Final Exam

- Short-answer questions
  - No multiple choice questions
  - Problem solving
  - Each question may have multiple sub-questions
- Paper based Exam and Online Exam
  - Restricted open book



# Wish You All Great Success!

- Secrets of Success

- [https://www.ted.com/talks/richard\\_st\\_john\\_8\\_secrets\\_of\\_success](https://www.ted.com/talks/richard_st_john_8_secrets_of_success)



# Thanks so much!