Universität Basel

Multimedia Retrieval

Chapter 0: Structure

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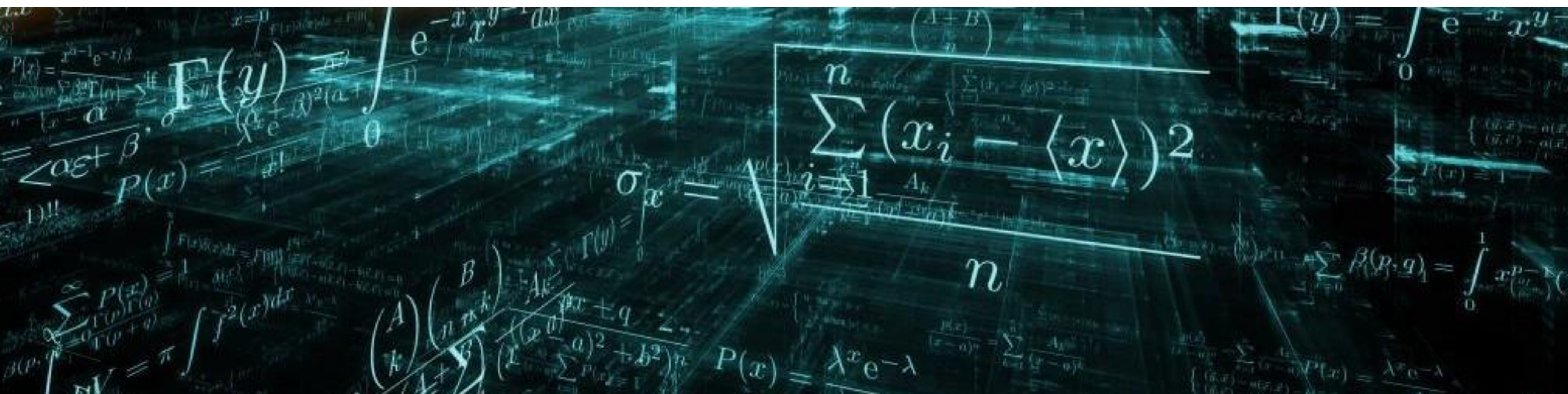

Classical Retrieval	1 - Introduction	We will cover the motivation, a short history, the general retrieval process and its variations, and watch demonstrations to get started.
	2 - Classical Text Retrieval	We discuss the main classical retrieval models: Boolean, vector space, and probabilistic. We conclude with BM25, the leading model used in many systems today.
	3 - Performance Evaluation	We evaluate and compare retrieval systems to determine how well the methods described in the chapters perform. Focus is on precision and recall related metrics.
	4 - Advanced Text Processing	We study how to extract improved text features, examine tokenization strategies for machine learning, and discuss various linguistic analysis and transformation methods.
	5 - Index for Text Retrieval	We explore methods to quickly find relevant documents and study Lucene, a widespread library that provides classical and modern text retrieval capabilities.
Advanced Retrieval	6 - Semantic Search	We explore semantic search: first Latent Semantic Indexing, then word embeddings, and finally modern transformer-based semantic search.
	7 - Vector Search	We examine the challenge of searching embeddings and feature vectors. We explain the curse of dimensionality and review techniques used by vector search engines today.
	8 - Retrieval Augmented Generation	We show how large language models can improve responses to users by using retrieved information. We apply this approach to text search.
	9 - Web Search	We study web retrieval, specifically methods that influence rankings using the relationships among documents or web pages.
Multi Modal Retrieval	10 - Multimodal Content Analysis	We explain multimodal content analysis and how to evaluate extracted features using a confusion matrix. We present metadata extraction as a simple method to bridge the semantic gap.
	11 - Visual Features	We cover the human perception of visual signal information and examine several algorithms for extracting features that describe color, texture, and shape aspects found in the images
	12 - Acoustic Features	We cover the human perception of audio signals and study various algorithms for extracting features in both the time and frequency domains.
	13 - Spatiotemporal Features	We present simple methods to describe how videos change over time and across space.
	14 - Classifiers	We study network architectures that extract classifiers from images and audio files to serve as focused content descriptors.
	15 - Multimodal Search	We use transformer-based models to generate improved descriptions and classifiers and examine how to integrate them into the retrieval process.
	99 - ML Methods	We review key machine learning methods used for content analysis and for extracting metadata. This chapter is not part of the exam; it is supplemental material to help you understand the methods discussed in this course.

Timeline and Organization of the course

Date	Theory: 15:15 / 16:15	Practice: 17:05	Where*
Sep 19	1 - Introduction, 2 - Classical Text Retrieval		University*
Sep 26	2 - Classical Text Retrieval	Ex 1 (new)	University*
Oct 3	3 - Performance Evaluation		**Zoom****
Oct 10	4 - Advanced Text Processing	Ex 1 (discuss), Ex 2 (new)	**Zoom****
Oct 17	5 - Index for Text Retrieval		**Zoom****
Oct 24	6 - Semantic Search	Ex 2 (discuss), Ex 3 (new)	University*
Oct 31	7 - Vector Search	Prep Exam	University*
Nov 7	8 - Retrieval Augmented Generation, 9 - Web Search	Ex 3 (discuss), Ex 4 (new), deep learning	University*
Nov 14	10 - Multimodal Content Analysis	Ex 4 (discuss), Ex 5 (new)	University*
Nov 21	11 - Visual Features	Ex 5 (discuss), Ex 6 (new)	University*
Nov 28	*No Lessons (Dies Academicus, last Friday in November)*		
Dec 5	12 - Acoustic Features	Ex 6 (discuss), Ex 7 (new)	University*
Dec 12	13 - Spatiotemporal Features, 14 - Classifiers	Ex 7 (discuss), Ex 8 (new)	University*
Dec 19	14 - Classifiers, 15 - Multimodal Search	Ex 8 (discuss), Eval & Prep Exam	University*

- **Theory:** Please study the material in advance. During lessons, we will cover the essentials with demonstrations and discussions, but some details will be left for self-study to keep a good pace. Check the schedule and announcements in ADAM. As a general rule, aim to read about one chapter ahead.
- **Practice:** During the third hour, we combine theory and hands-on exercises. We work with Python and software packages related to the retrieval topics we cover. This session is optional, but active participation can help you in the exams, as outlined on the next page

* University: Spiegelgasse 5, Seminarraum 05.002, **no zoom available**, **no video uploads** after lecture
** Zoom: see meeting link on Web / in ADAM, video uploads after lecture