The ISMIR Cloud: A Decade of ISMIR Conferences at Your Fingertips

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Introduction

- Many available ISMIR publications nowadays
- Typical access to publications: by meta data or literal text search
- Our proposal: access by **latent semantic structure** of ISMIR corpus. Aims:
  - Facilitate **concept oriented** access to cumulative ISMIR proceedings
  - Provide an overview of significant **ISMIR topics** (and their **evolution** over the years)

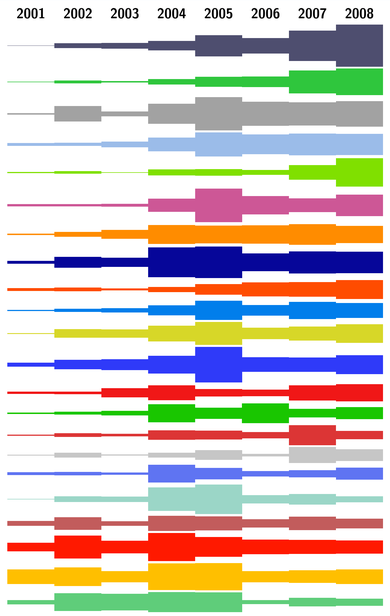
Method

Latent semantic indexing:

- Build **term list**: noun phrases from publications, via part-of-speech tagging
- Filter term list: remove if corpus frequency $<$ web frequency $+ \epsilon$
- Build **term-document matrix** $\boldsymbol{V}$: term-frequencies per document
- **Nonnegative matrix factorization (NMF)**: $\boldsymbol{V} \approx \boldsymbol{W} \cdot \boldsymbol{H}$
  $\boldsymbol{W_{ij}}$: activation of term $\boldsymbol{i}$ for concept $\boldsymbol{j}$
  $\boldsymbol{H_{jk}}$: activation of document $\boldsymbol{k}$ for concept $\boldsymbol{j}$

$\boldsymbol{V}$, $\boldsymbol{W}$, and $\boldsymbol{H}$ provide basis for **analysis** and interactive **applications** of the ISMIR publication corpus

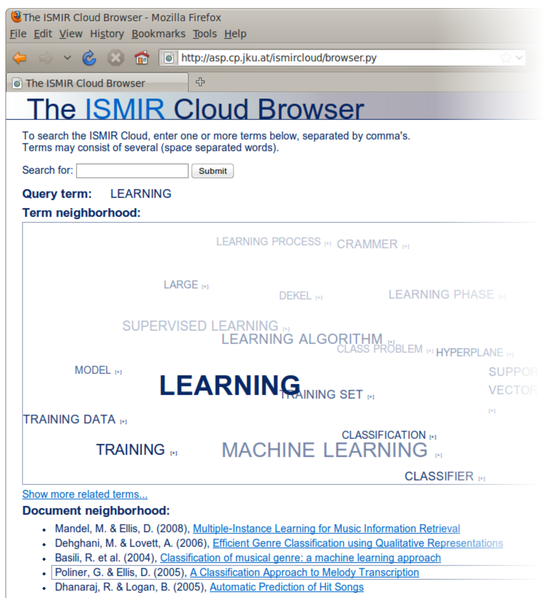
Evolution of ISMIR topics over time



vocabulary, kernel, svm, lanckriet, turnbull, barrington, whitman, classifier, support vector, emotion, data set, artist, annotation, precision, music annotation
recommendation, recommender, recommendation accuracy, aspect model, rating matrix, tensor, music recommendation, collaborative filtering, hybrid
play list, artist, play list generation, music collection, visualization, music similarity, pampalk, pachet, generation, rock, seed, user, song, cluster
chord, pitch class, key finding, chord recognition, minor, chroma, key, krumhansl, chord sequence, spiral, tonality, major, chew, pcp, class profile, pitch class profile
rdf, music ontology, ontology, semantic web, foaf, musicbrainz, owl, dbpedia, raimond, dbtune, interlinking, jamendo, time line, predicate, web service, bizer
jaudio, marsyas, mcgill, mckay, worker, arff, fujinaga, mcennis, weka, fiebrink, mcgill university, xml, prototyping, feature extraction, dispatcher, mcgill university montreal
musical instrument, clarinet, instrument, flute, sound source, rwc, instrument recognition, instrument identification, violin, source separation, oboe, separation
onset, onset detection, detection function, transcription, estimation, frame, factorization, note onset, music transcription, piano, alignment, matrix factorization
omr, optical music recognition, music recognition, aruspix, early music, gamera, gamut, binarization, pugin, droettboom, omr process, document
synchronisation, audio synchronization, syncplayer, bonn, kurth, chroma, alignment, audio matching, uni bonn, audio recording, dtw, music synchronization
non vocal, singing, vocal, singing voice, singer identification, singer, voice, accompaniment, gmm, speaker, vocal segment, wang, tsai, vocal segmentation, sung
genre classification, feature set, music genre classification, loudness, classification accuracy, critical band, musical genre, music genre, classifier, sone,
emd, triangle inequality, ground distance, transportation distance, point set, veltkamp, ptd, triangle, partial matching, inequality, search radius, melodic similarity
meter, rhythm description, tempo induction, beat tracking, induction, periodicity, beat, gouyon, dixon, auto correlation, tempo, tempo extraction, ballroom
mirspectrum, miraudio, mirautocor, mirtoolbox, mirtempo, mysong, mirfilterbank, mirenvelope, mirframe, mirsum, coefficient value, audio waveform, toolbox
time span tree, gttm, time span, grouping structure, sgpr, structure analyzer, groupingxml, low level boundary, metrical structure, hirata, span, time span reduction
enp, enp score, laurson, kuuskankare, mensural notation, enp score notation, non mensural notation, music notation program, context sensitive menus, frame notation, sibelius academy
drum, snare, bass drum, snare drum, bass, gillet, drum sound, percussion, drummer, drum track, drum transcription, hi hat, stroke, drum pattern, gouyon, cymbal
fingerprint, fingerprinting, audio fingerprinting, sub fingerprint, fingerprint extraction, fingerprint block, haitsma, fingerprinting system, kalker, audio fingerprint,
library, digital library, music library, metadata, smiraglia, digital music library, frbr, entity, indiana university, downie, information science, searching
pattern matching, string matching, string, interval, approximate, pattern, matching, approximate matching, meredith, matching problem, running time, cambouropoulos
mrr, birmingham, qbh, target, sung, humming, meek, contour, insertion, alignment, pardo, deletion, query, rank, shifrin, error model, musart, ioi, reciprocal rank

- 22 **concepts** extracted from ISMIR corpus using NMF
- Let $\boldsymbol{K}$ be all documents for year $\boldsymbol{y}$, then $\sum_{\boldsymbol{k} \in \boldsymbol{K}} \boldsymbol{H_{jk}}$ is the total activation of topic $\boldsymbol{j}$ in $\boldsymbol{y}$
- This can reveal **trends** in popularity of ISMIR topics
- e.g. Music-recommendation and annotation-based processing are **booming**; Less attention for QBH and drum-transcription since 2005

Web-Application: The ISMIR Cloud Browser



- Public access: `http://www.cp.jku.at/projects/ISMIR-cloud`
- **Search** ISMIR publications for (conjunctions of) terms
- Shows **related terms** and **documents** for query terms
- Shows which related terms occur in which document
- Links to online **pdf** documents

Implementation:

- Term cloud representation via **PCA** on submatrix of $\boldsymbol{V}$
- Term size computed as **concept co-activation** ($\boldsymbol{W}$) with query
- Related documents: the $\boldsymbol{k}$ documents from corpus $\boldsymbol{D}$ with highest 'concept **cosine similarity**' to query $\boldsymbol{Q}$:

$$\textbf{argmax}_{\boldsymbol{d} \in \boldsymbol{D}} \prod_{\boldsymbol{q} \in \boldsymbol{Q}} \textbf{cos}(\boldsymbol{W_{q\cdot}}, \boldsymbol{H_{\cdot d}})$$

ISMIR 2009, 10th International Society on Music Information Retrieval Conference, 26th – 30th October 2009, Kobe, Japan