Outline

1. MediaCycle
2. Demo (Seneffe)
3. Temporal Segmentation
4. Optimization (StarPU = GPU + CPU)
5. "Semantic" Text Similarity
6. Perspectives
   - (Timed+Spatial) Annotation
   - Optimization
   - MediaCycle Releases
MediaCycle software: Overview

- goal: content-based organization of multimedia databases

Multimedia:
- Audio
- Image
- Video
- Text

Artistic applications
- *Méta-crâne* (Thomas Israël)
- *DANCERS!* (Bud Blumenthal)
- *BorderLands* (Christian Graupner)
MediaCycle software: Overview

- modular architecture
  - core: database management (= server)
  - plugins: media analysis
  - various interfaces (= client)
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Video segmentation: Screenflow of the current prototype

("Big Buck Bunny", Blender Movie)
**BIC Segmentation**

- segment = set of subsequent video frames which share a common characteristic (i.e., a feature or a set of features)
- Bayesian Information Criterion (BIC), originally introduced to estimate the number of parameters of a model (Schwarz, 1978)

1 segment

2 segments
BIC Segmentation

- balance fit (model, data) and number of parameters in model
- suppose we have N video frames
- for each frame we extract a vector \( x \) of features
- compare 1 segment \((x_1 \ldots x_N)\) vs. 2 segments \((x_1 \ldots x_i \text{ et } x_{i+1} \ldots x_N)\):
  
  \[
  \Delta BIC(i) = N \log |\Sigma| - \left( N_1 \log |\Sigma_1| + N_2 \log |\Sigma_2| \right) - \lambda P
  \]

  where the penalty is

  \[
  P = \frac{1}{2} \left( d + \frac{d}{2} d(d+1) \right) \log N
  \]

  - \( d = \) dimension of the features; \( \Sigma = \) covariance matrix
BIC Segmentation - results

- automatic detection of segments with 2 features

- can be used "on-the-fly"
Self-Similarity Segmentation

- self-similarity matrix for a feature along time is used for segmentation
Segmentation - Open questions

- which features are relevant for segmentation?
- how to validate?
- how to compare media using segmentation?
  - Number of segments,
  - Feature evolution across segments,
  - Find similar segments in different videos
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Motivations

- increasing computational power of Graphics Processing Units (GPU)

- CUDA (Compute Unified Device Architecture) API from NVIDIA

- feature extraction plugins for MediaCycle using GPUs
Multi-CPU/Multi-GPU using StarPU (1)

- High-res media: parallel processing on GPU.
- Scheduling CPUs/GPUs
Multi-CPU/Multi-GPU using StarPU (2)

- Hu Moments + Contours extraction on hybrid platforms.
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"Semantic" Similarity
Current Project with La Médiathèque

- integrate music metadata/recommendation providers: LastFM, EchoNest...
- “tags” become features for the similarity computation

http://www.archipels.be
"Semantic" Text Similarity

- lexicon of terms to count
- count occurrences in each document ($\rightarrow tf$)
- count documents in which the term appears at least once ($\rightarrow itf$)
- give more weight to uncommon terms
- $tf \times itf$
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Perspectives: (Timed + Spatial) Annotation

- Manual Annotation, towards Semi-Automatic
  - early integration of the Torch3 library for classification
  - goal: on-the-fly annotation
    1. user annotates a subset
    2. propagated to set
    3. correction
  - benefits: for clustering and classification
- Spatial Annotation (Visual Media)
More StarPU-enabled algorithms:

- Using the brand new OpenCV 2.2 GPU-accelerated algorithms (developed by NVidia)
- Audio FFTs on GPU
Perspectives: MediaCycle Releases

MediaCycle Release Roadmap:

- **Soon**
  - ✓ OSX (32-bit)
  - ✓ Ubuntu (from 10.04)
- **Future**
  - □ Windows 7
- **Remote**
  - □ IOS (on device: iPad)
  - ✓ Android (client/server)