Cut Based Video Retrieval

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Overview

1. Introduction
2. Cut Detection
3. Algorithms
4. Framework
5. Evaluation

Objective / Motivation

- Find duplicate videos
- Search for video metadata
- Lizence checking

- Cryprograpic hash functions are not suitable
- No end-user software
- Specialized for movies

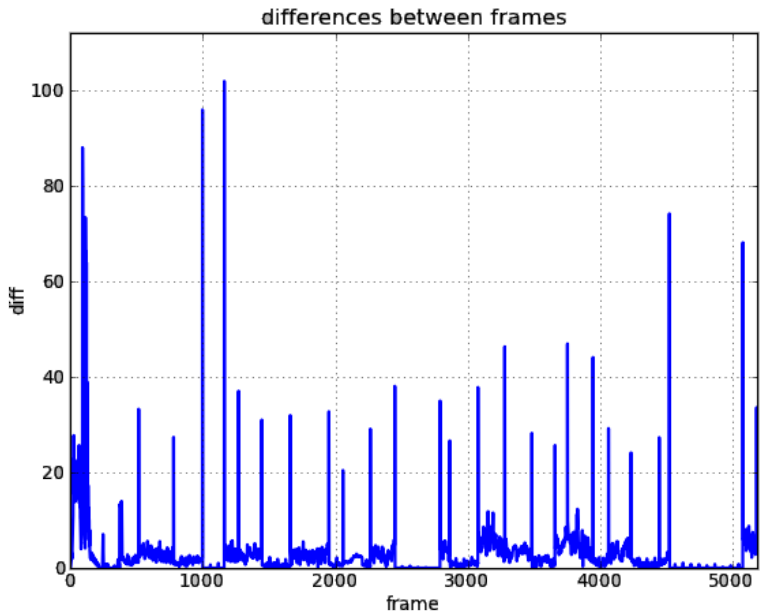
Challenges

- Resolution
- Brightness/Contrast
- Compression
- Blur
- Flip
- FPS
- TV-Inpaintings
- ...

My Concept

- Video is a sequence of cuts
- Use cuts only
- Minimal image information
- Makes it robust to most image variations

Detecting Cuts



Definition

$$diff[t-1] \leq \frac{diff[t]}{2} \geq diff[t+1] \text{ and } diff[x] \geq 10$$

Cut Detector Linitations

- Doesn’t detect fades
- Doesn’t detect detected
- Problems with captured videos

(a) First frame

(b) Cut frame

(c) Next Frame

Matching Videos

- Extract a descriptor per cuts
- Compare descriptor sequence to each database entry
- Find longest common subsequence
- Alternative minimal distance subsequence
- Takes about 3 sec for 500 videos

Normalized Time

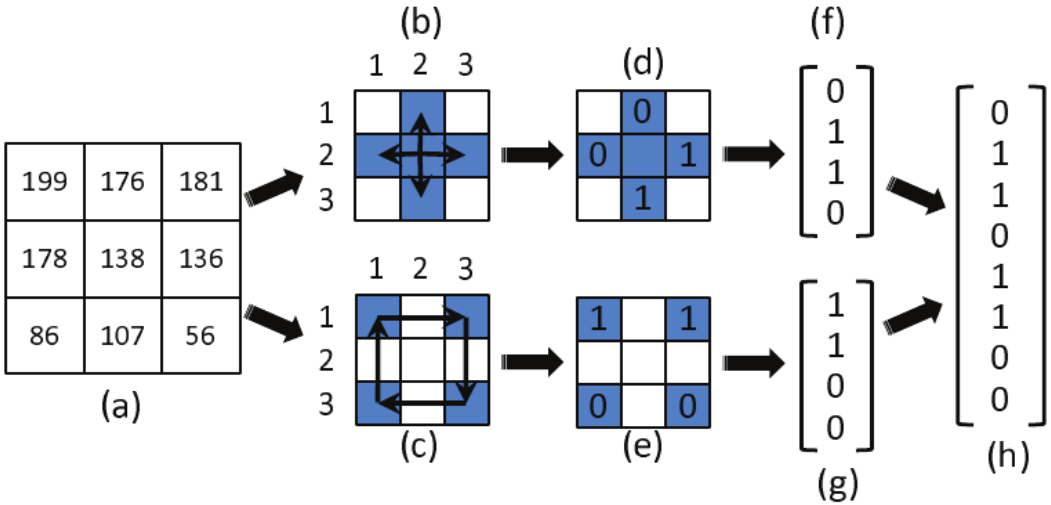
- Used normalized frame count's
- One float per cut
- Around 2.8bit per cut (Entropy)

Definition

$$d[n] = \frac{cut[n] - cut[n-1]}{cut[n+1] - cut[n]}$$

LBP-Sequence

- Local binary pattern
- Compare intensity on 3x3 grid
- One byte per image
- Two bytes per cut (frame before, frame after)



Other Descriptors

- DCT2D
  - Discrete Cosine Transformation
  - 8x8 Lowest frequencies
  - Tresholding with median $\Rightarrow$ 64-bit descriptor
- Gist
  - 4x4 Locations
  - 8 Orientations

STTBV (Reference)

- Spartio-Temporal Transform Based Video Hashing
- Scales Video to 32x32 Pixel, 64 Frames
- Uses 3D DCT
- 4x4x4 Lowest frequencies
- Trasholding with median $\Rightarrow$ 64-bit Descriptor

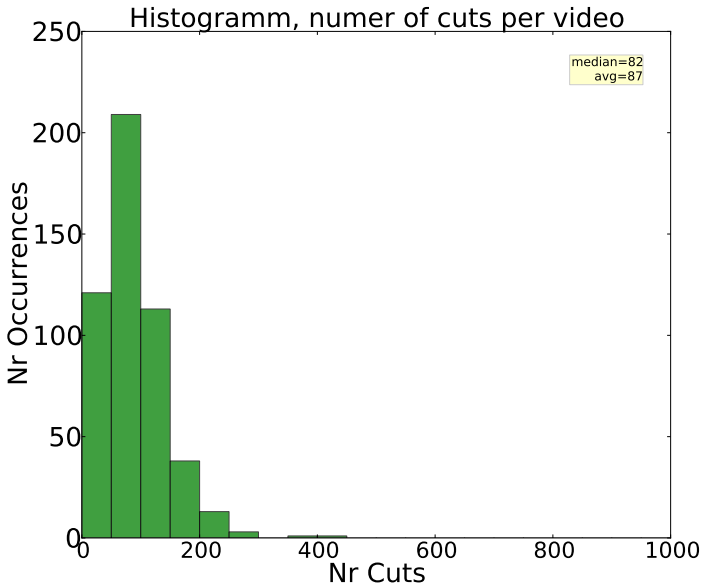
Framework

- C++/openCV
- Qt/Sqlite
- Filtergraph
- Python evaluation
- Realtime on one CPU Core

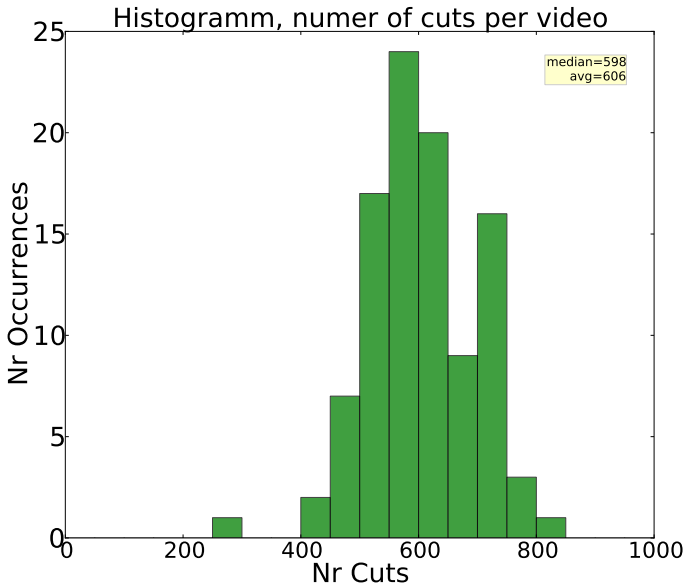
Dataset

- 500 TED-Talks
  - Conference recordings
  - Creative Commons license
- 100 Stargate SG1 Episodes
  - Typical movie

Dataset Statistic

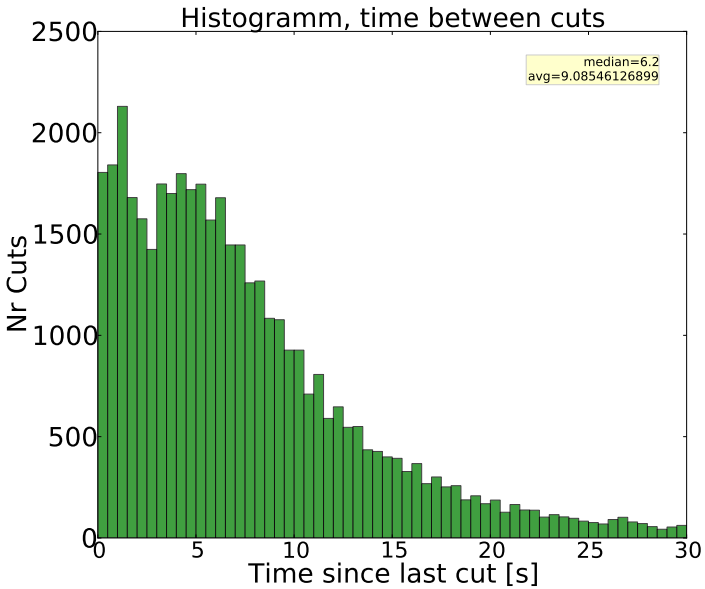


(d) TED

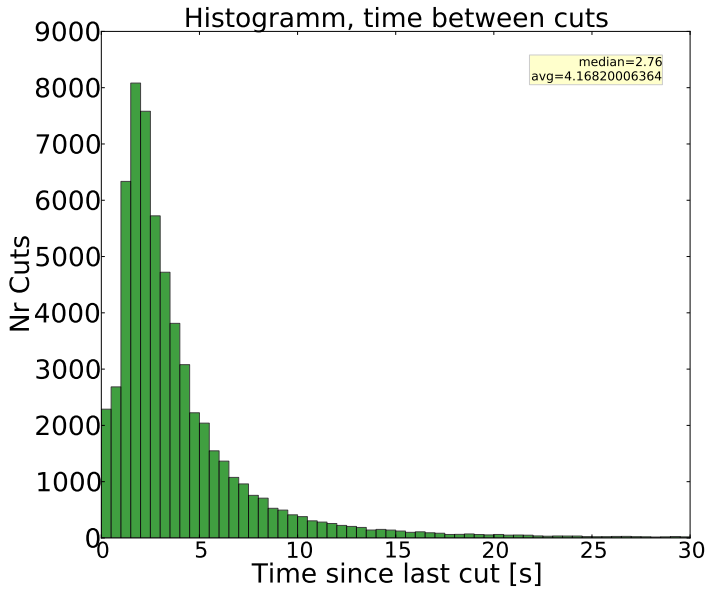


(e) Stargate

Dataset Statistic



(f) TED

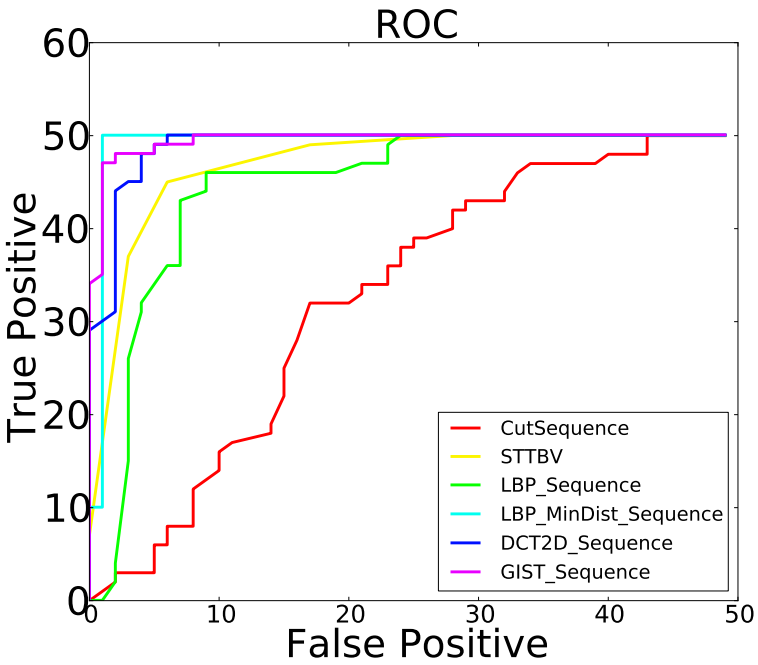


(g) Stargate

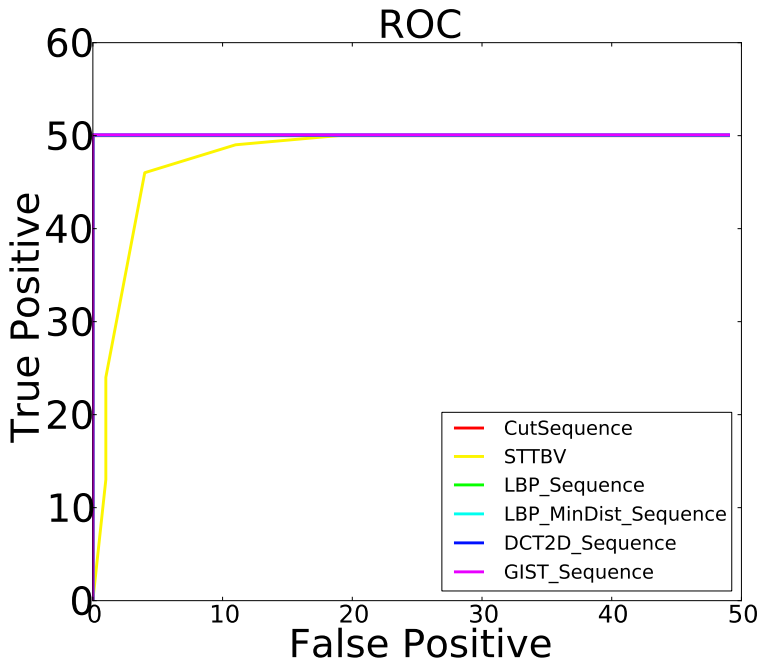
Duplicate Search

- Stargate / TED-Talk
- Test 50 Videos in Database
- Test 50 Videos not in Database (Same Series)
- 10% truncated
- 0.1 Watermark
- Resize to 200x150 Pixel

Duplicate Search



(h) TED

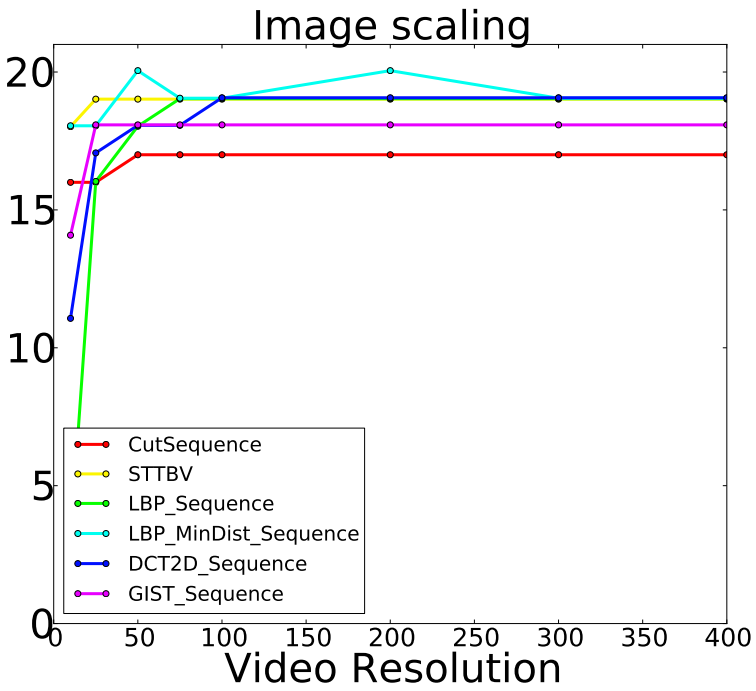


(i) Stargate

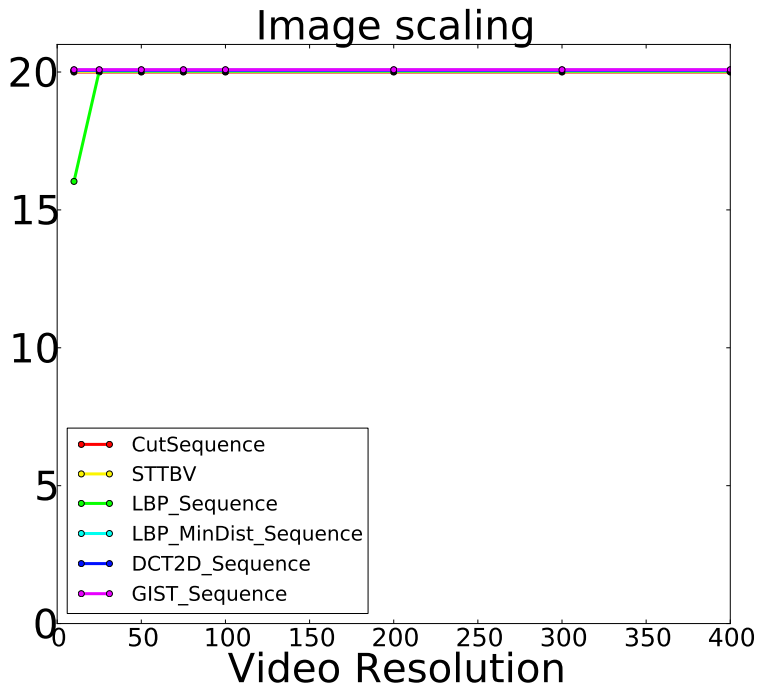
Retrieval Results

- 20 Test videos
- Check if video is correctly classified
- Modifiactions: Resolution, Framedrop, ...
- Use parameter variation

Retrieval Results (Image Scaling)

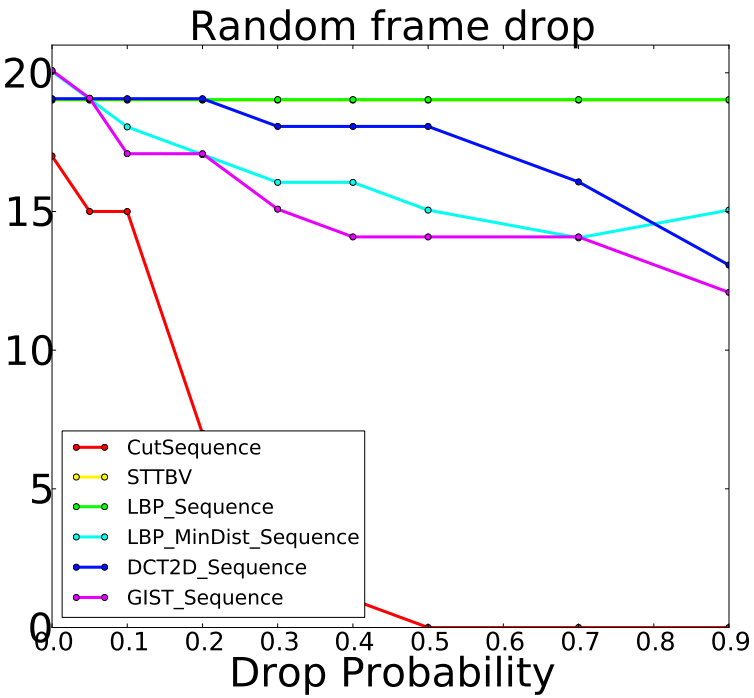


(j) TED

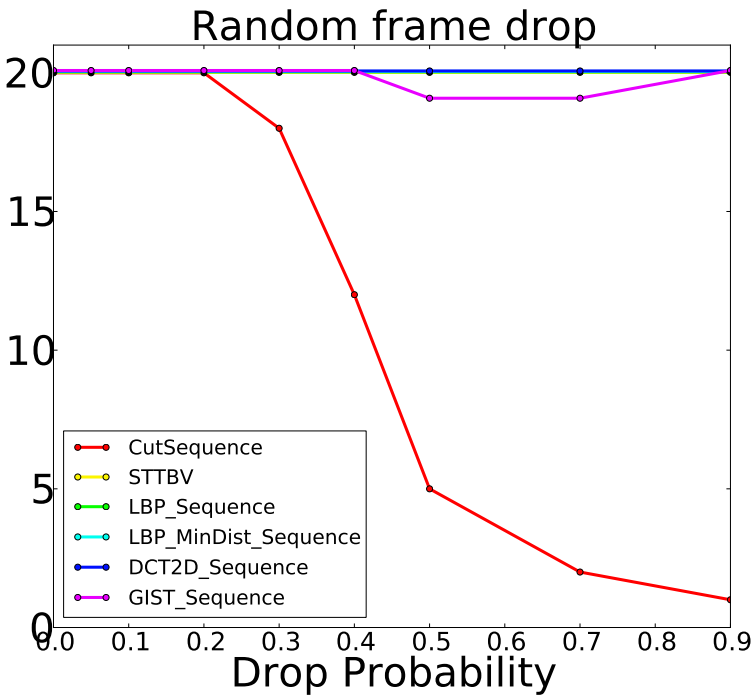


(k) Stargate

Retrieval Results (Frame Drop)

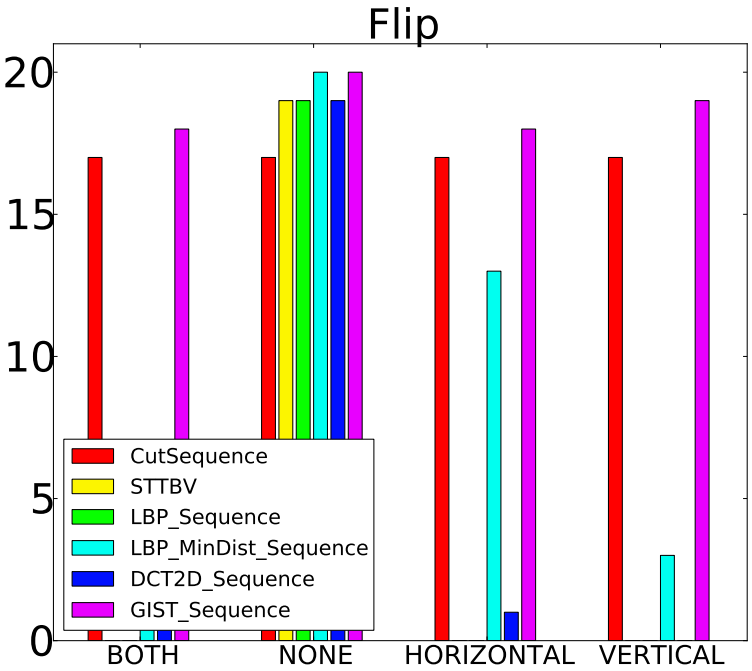


(l) TED

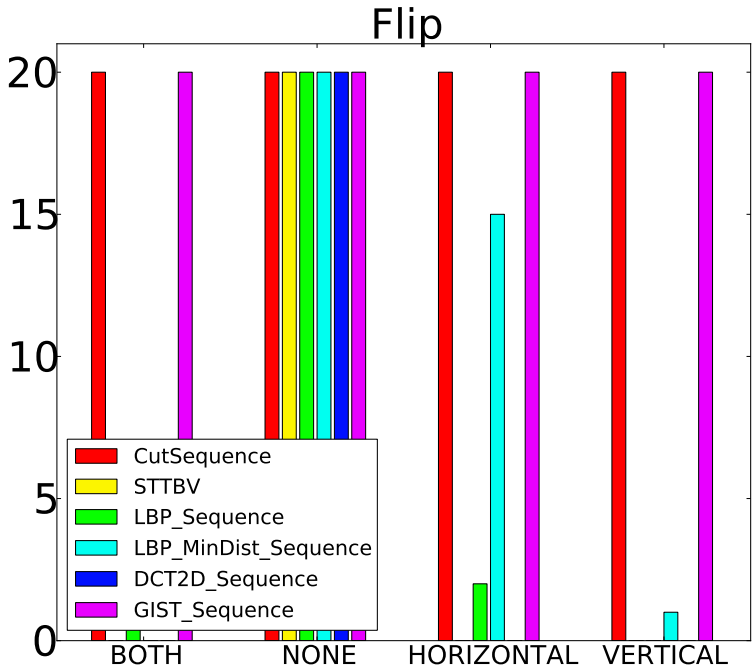


(m) Stargate

Retrieval Results (Flip)

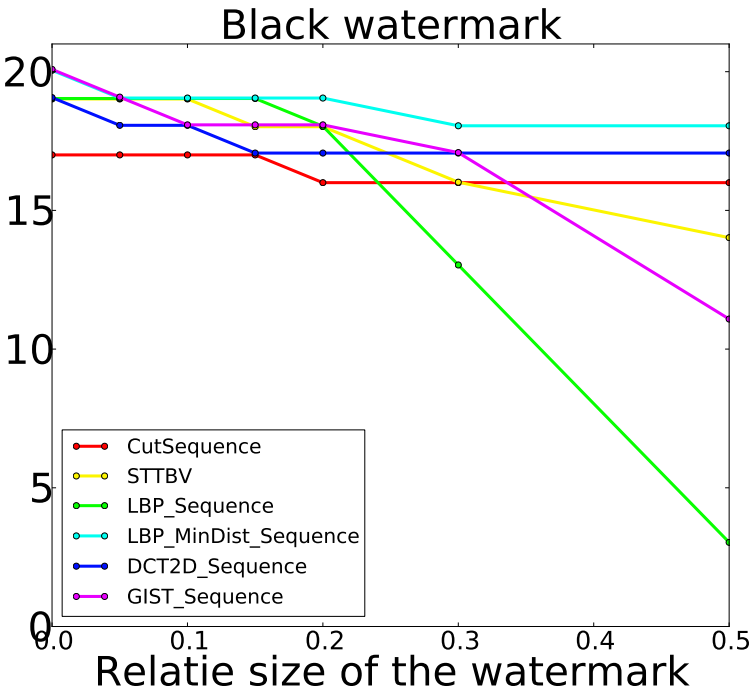


(n) TED

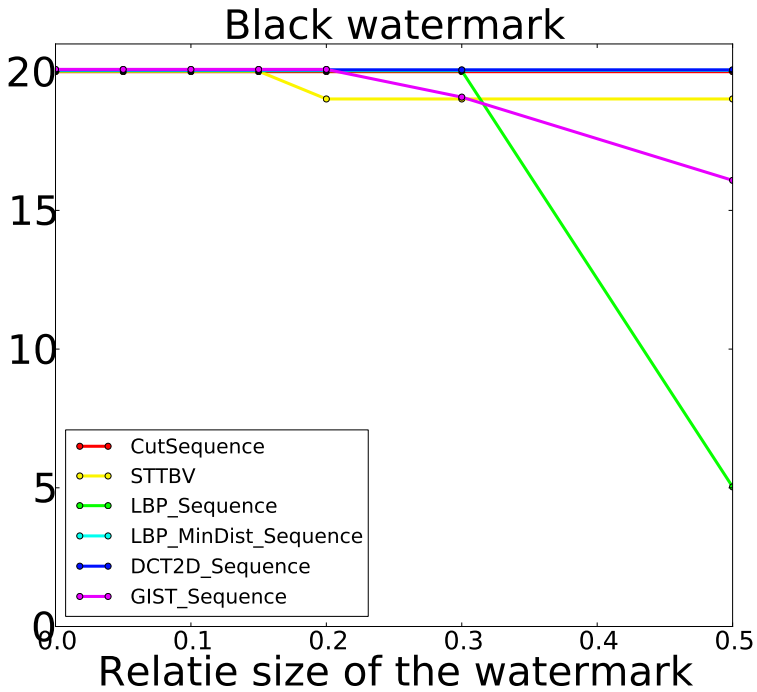


(o) Stargate

Retrieval Results (Watermark)

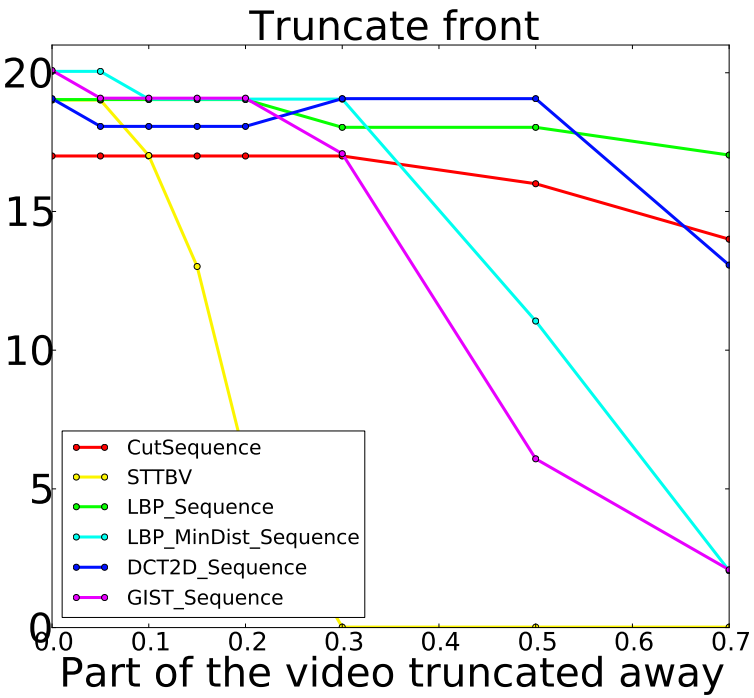


(p) TED

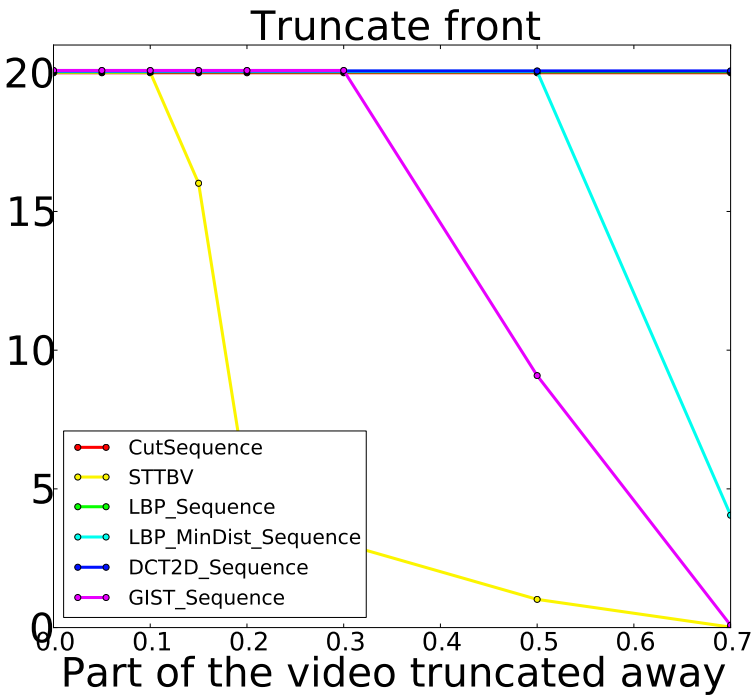


(q) Stargate

Retrieval Results (Truncated)

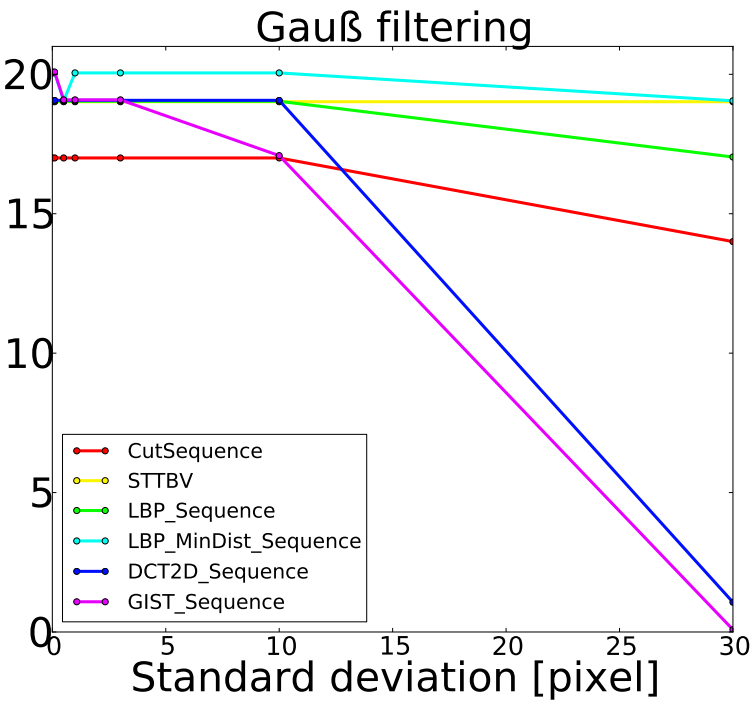


(r) TED

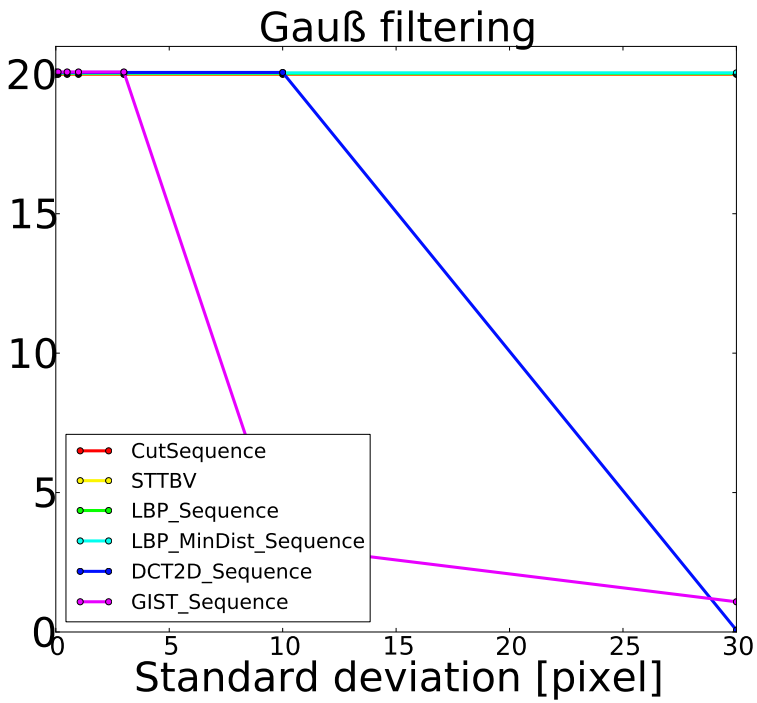


(s) Stargate

Retrieval Results (Bluring)



(t) TED



(u) Stargate

Conclusion

- Works well for movies
- Not suitable for arbitrary content
- Very robust
- Requires cuts

End

Questions?