Towards Automated Quality Curation of Video Collections from a Realistic Perspective

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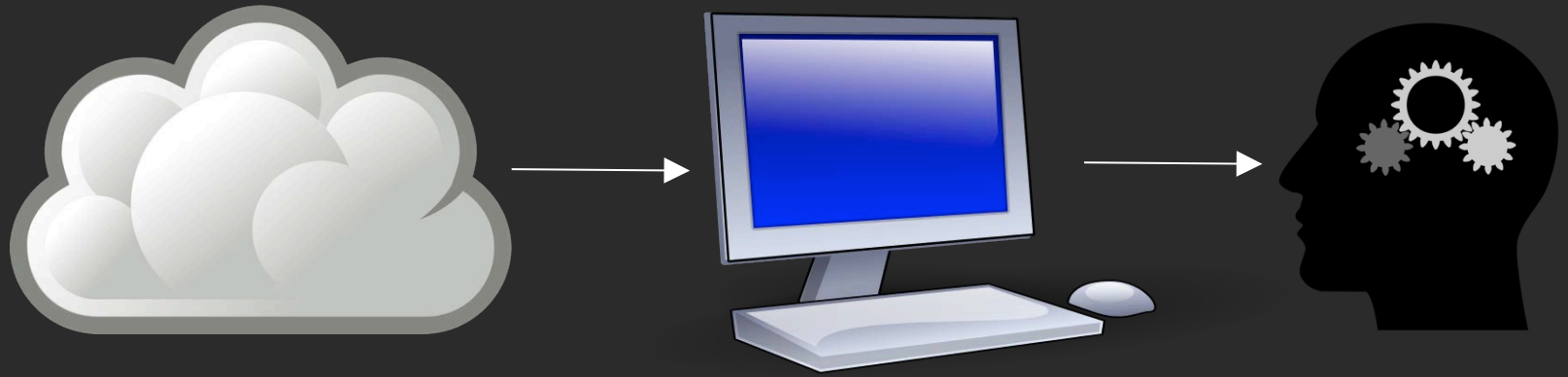
Outline

- How do humans view picture quality?
- Problem and Motivations for this research
- Video Art Corpus
- Subjective Study Overview
  - Testbed
  - Human Opinions
- Natural Scene Statistics
- Video Quality Assessment
  - BRISQUE
  - Video BLIINDS
  - Results
  - Evaluation of Outliers
- Conclusion/Future Work

How do humans view picture quality?

First, why do we care what humans think?



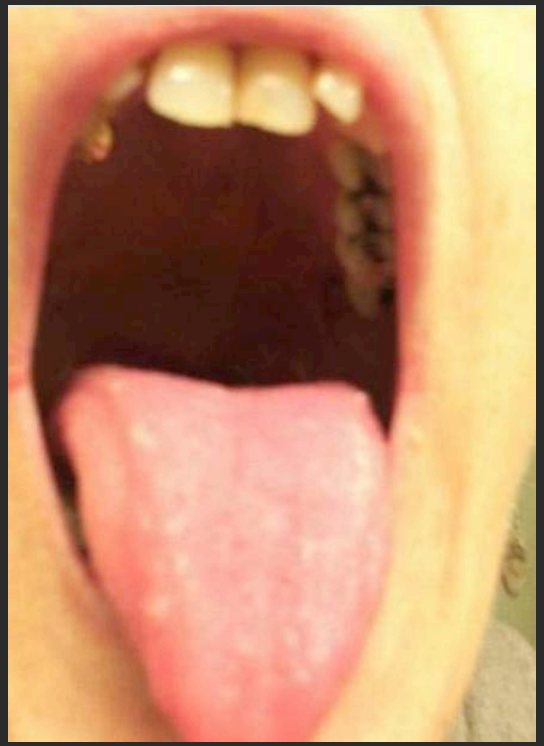
Humans are the final consumers of content!

How do humans view picture quality?

Which image is better?

How do humans view picture quality?

Which image is better?



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Problem and motivations for this research

Problem: Asses any real-world video collection with reasonable accuracy.

- Any sizeable video collection will contain videos of good and bad quality.
- Bad quality videos may contain one or more issues.
    - Multiple transcoding processes/migrations/conversions
    - Multiple distortion types like blocking and flicker
- Often no pristine reference video exists for comparison.
    - No-Reference algorithms a must
- Manual assessment is not feasible (due to scale, precision and lack of overall score for comparison).
- Current objective automated methods require manual interpretation.

Motivation: Assess a video art collection from the University museum.

- More generally, automate quality assessment of video collections.
- Predict subjective quality on each video.
- Use predictions for making preservation and access decisions.

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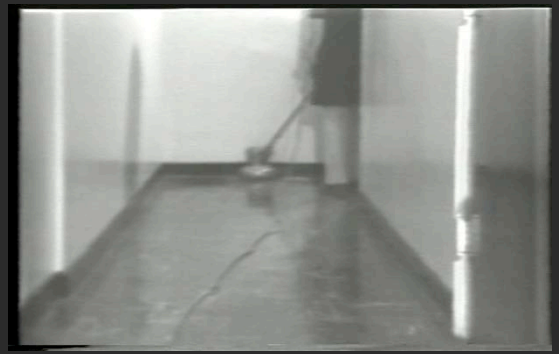
Video Art Corpus

- 17 videos.
- Majority created between 2000 and 2008.
- Some digitally manipulated.
- DVD/Mpeg2.
- Copyright protected.
- ~50,000 frames each.



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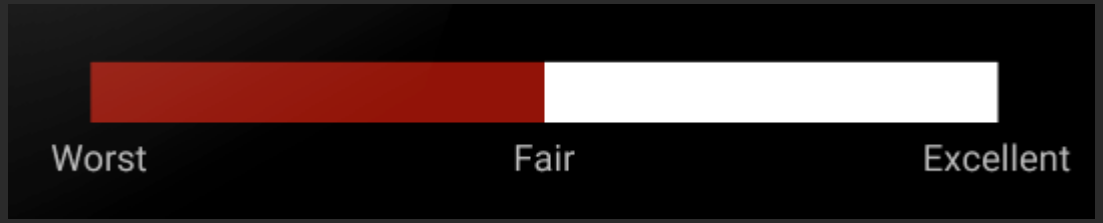
Subjective Study Overview: Testbed

- Realistic testbed with human ratings
  - Ten second clips collected from different artistic sources including from the the University museum collection (Corpus).
  - Total of 120 clips each with an average human opinion score.
  - Each clip unique and distortion ground truth unknown.
  - No reference videos.
- What about existing datasets (as testbeds) like LIVE or CSIQ?
  - Single distortions added to handfull of high quality video sources.
  - Do not capture the content types or distortion types observed in larger collections.

Subjective Study Overview: Human Opinions

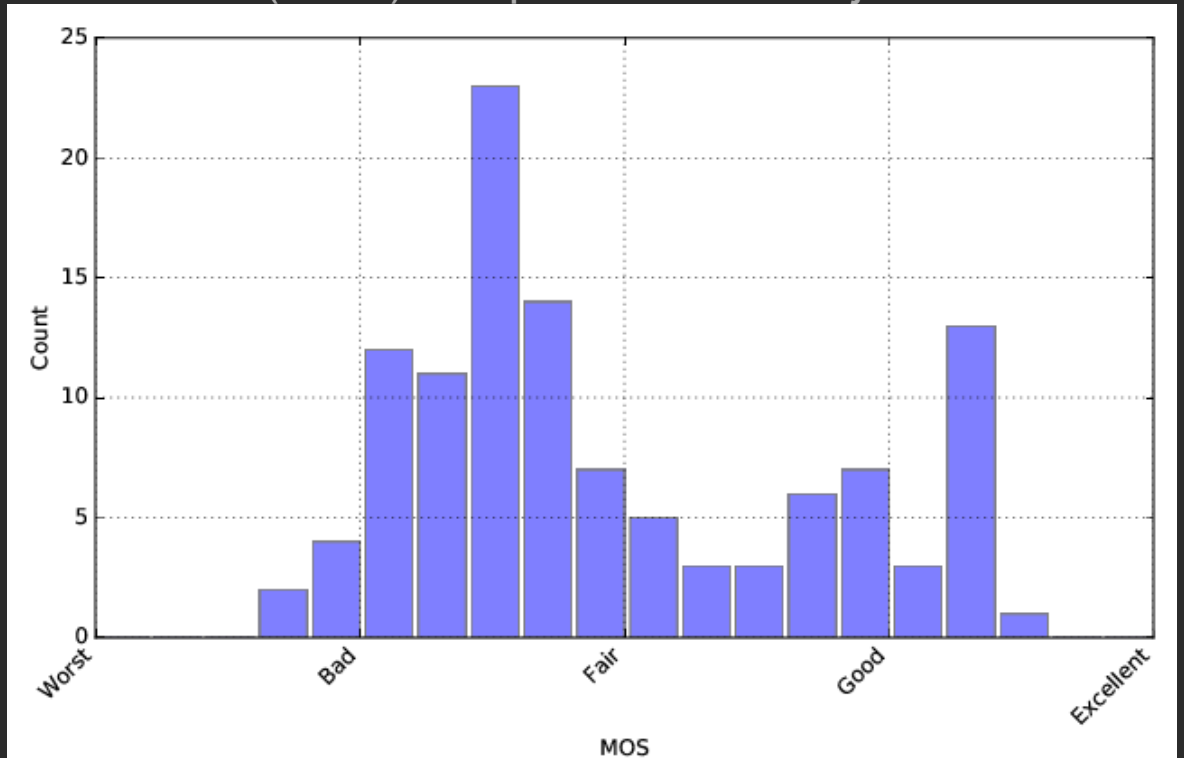
Video Quality Rating Task:

- 45 subjects.
- View Video on a tablet under controlled environment.
- Rate video quality on a continuous scale.



Subjective Study Overview: Human Opinions

- Mean Opinion Score (MOS) computed on 37 subjects



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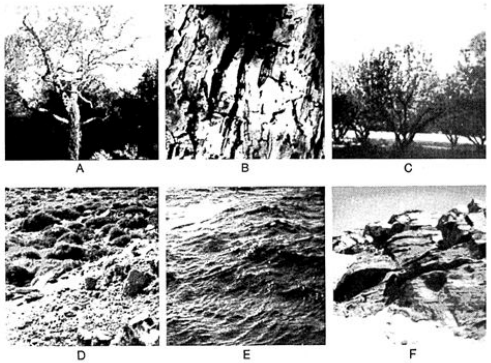
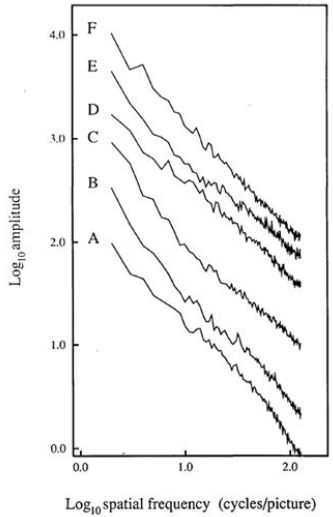
Natural Scene Statistics

1/f amplitude spectra for natural images



There are statistical regularities in the natural world, and image statistics reflect that.

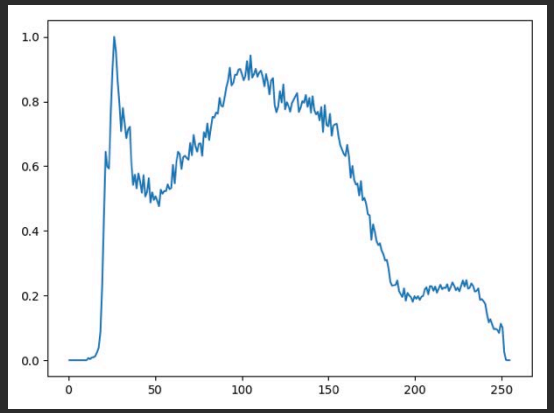
(Burton & Moorehead 1987; Field 1987; Tolhurst et al. 1992)



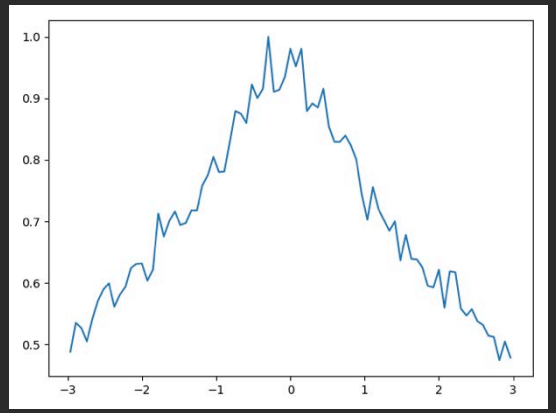
(Field 1987)

Natural Scene Statistics

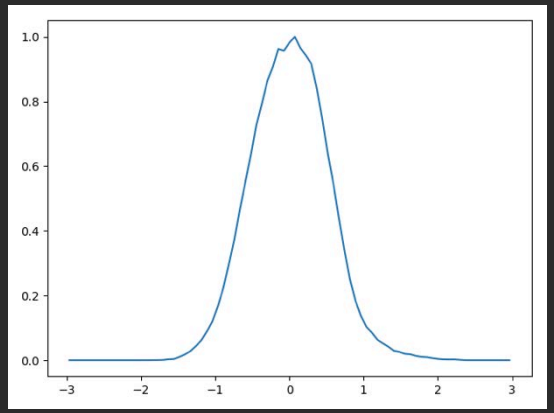
Image Histogram



Mean-subtracted image Histogram



Mean-subtracted Contrast-normalized Image Histogram



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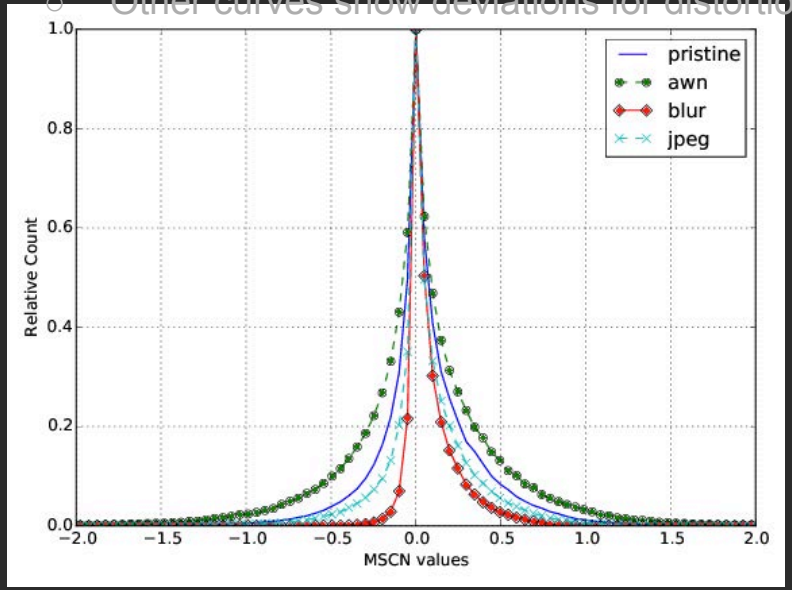
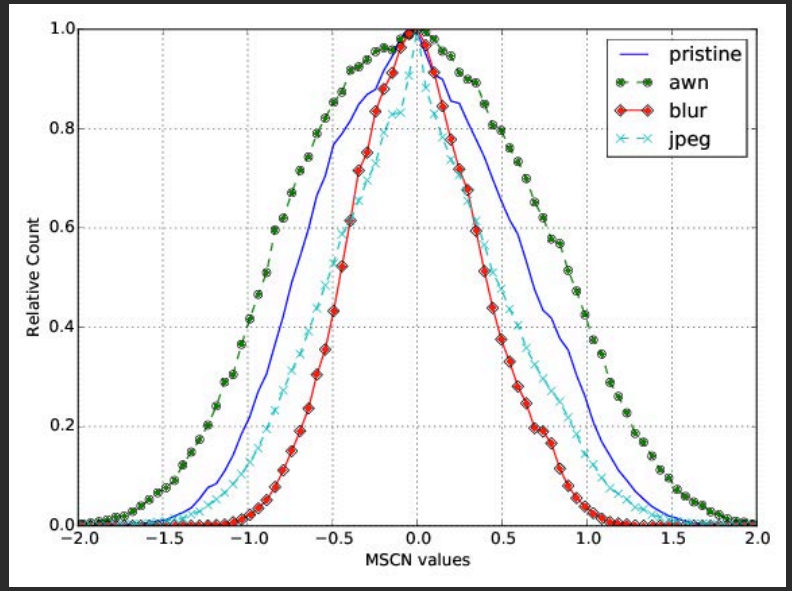
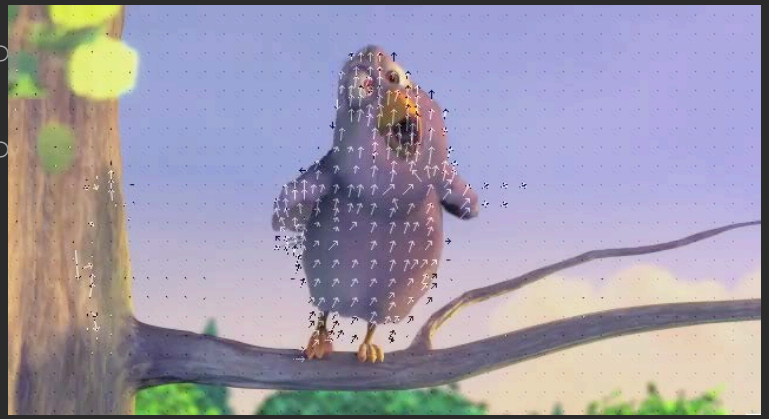
Video Quality Assessment: BRISQUE

- Blind Referenceless Image Spatial QUality Evaluator (BRISQUE)
  - Solid blue curve is observation for natural images and video.
  - Other curves show deviations for distortions.





Video Quality Assessment: Video BLIINDS

- Video BLIINDS
  - NIQE (naturalness)
  - DC Features (brightness changes over time like flicker)
  - NVS Ratios (frequencies over time)
  - 
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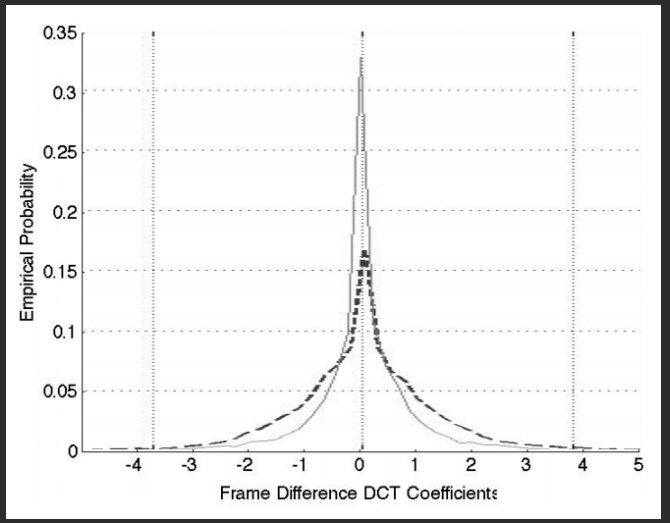


Video Quality Assessment: Results

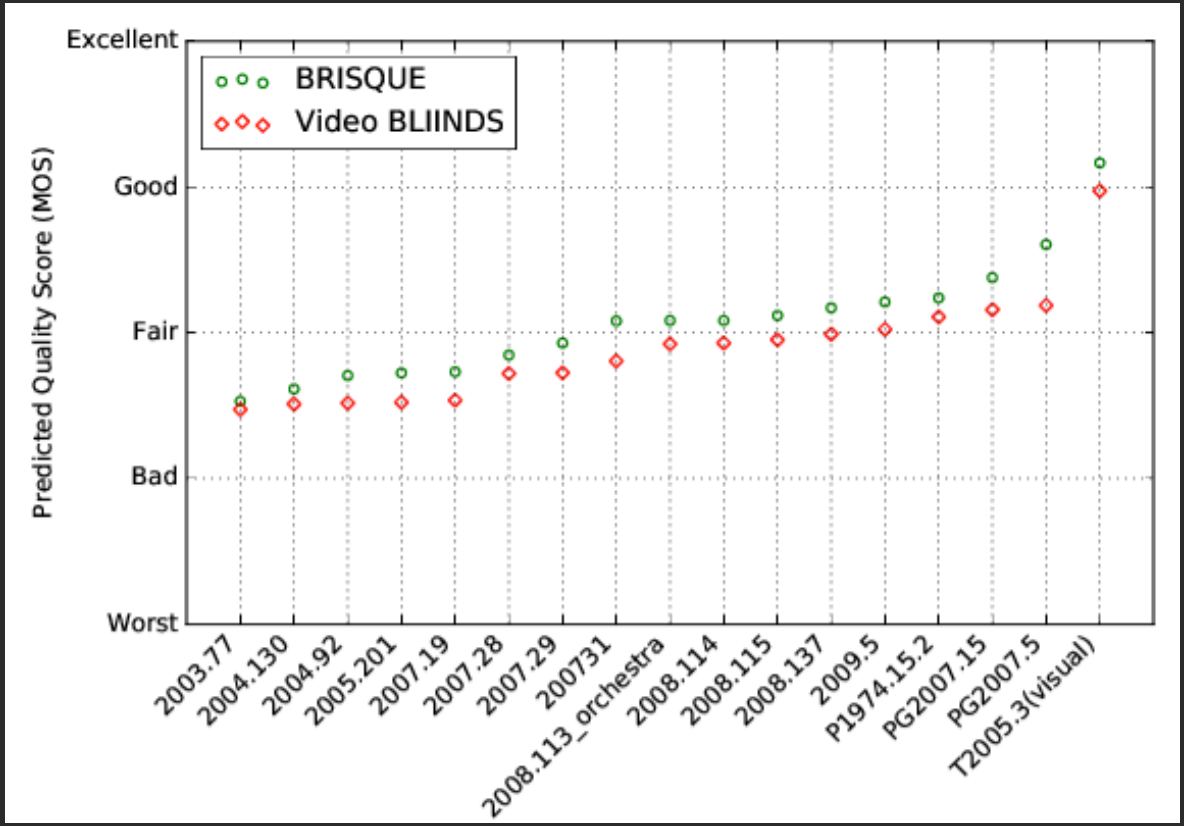
BRISQUE

Method	SRCC	MSE
*	0.7737	0.2605

Video BLIINDS

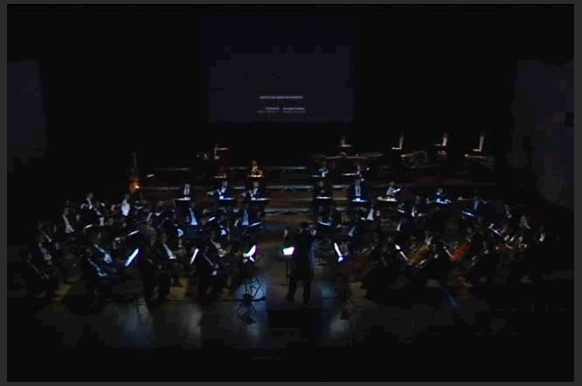
Method	SRCC	MSE
*	0.7688	0.2795
NIQE	0.7757	0.2774
DC Features	0.0086	1.1863
NVS Ratios	0.1455	1.0461
Coherency	0.3845	0.8783
Global Motion	0.2662	1.0416

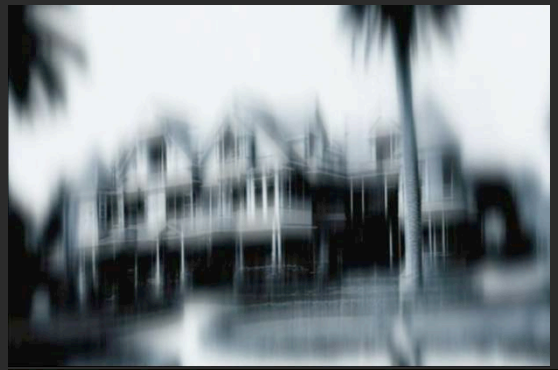
Video Quality Assessment: Results



Video Quality Assessment: Evaluation of Outliers

- The following videos were poorly predicted





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Conclusions and Future Work

- Developed a realistic video quality testbed.
- Used this testbed to successfully rank the video collection.
- Used High-Performance Computing to implement the computations with precision and scale
- Our dataset for testing is at: http://live.ece.utexas.edu/research/automated_video_collections/index.html
- Proved that we can use reliable, transparent methods to replace manual video quality assessment.
- Relevant to Computational Archival Science (CAS)
    - Models human assessment, allows collection's evaluation.
- Ongoing research to improve quality prediction algorithms.
    - Plan to use artifact detection frameworks for distortion identification.
    - These same frameworks can be used for quality prediction.
- We constructed an open-source dataset for the community.

References

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