MAKSIM SINIUKOV

RESEARCHER AT GRAPHICS AND MEDIA LAB,
COMPUTER SCIENCE STUDENT AT LOMONOSOV MOSCOW STATE UNIVERSITY

EDUCATION

Bachelor of Computer Science, Moscow State University named after M. V. Lomonosov   2019–2023
Applied Mathematics and Computer Science, Department of Intelligent Information Technologies,
Graphics and Media Lab

BACHELOR THESIS

Title: Stability study of image and video quality metrics

Supervisors: Dmitry Vatolin, Dmitriy Kulikov, Anastasia Antsiferova

Description: Video-quality measurement plays a critical role in the development of video-processing applications. In this regard, more and more metrics are under development, but little research has considered their limitations. In this paper, we show how video preprocessing can artificially increase the popular quality metric VMAF and its tuning-resistant version, VMAF NEG. We propose a pipeline that tunes processing-algorithm parameters to increase VMAF by up to 218.8%. A subjective comparison revealed that for most preprocessing methods, a video's visual quality drops or stays unchanged. We also show that some preprocessing methods can increase VMAF NEG scores by up to 23.6%.
We show how image preprocessing before compression can artificially increase the quality scores provided by the popular metrics DISTS, LPIPS, HaarPSI, and VIF as well as how these scores are inconsistent with subjective-quality scores. We propose a series of neural-network preprocessing models that increase DISTS by up to 34.5%, LPIPS by up to 36.8%, VIF by up to 98.0%, ADISTS by up to 21.3%, STLPIPS by up to 56.2%, CONITRIQUE by up to 63.7%, AHIQ by up to 101.2%, IQT by up to 110.5%, and HaarPSI by up to 22.6% in the case of JPEG-compressed images. A subjective comparison of preprocessed images showed that for most of the metrics we examined, visual quality drops or stays unchanged, limiting the applicability of these metrics.

SCIENTIFIC RESEARCH

Publications

- Siniukov et. al Hacking VMAF and VMAF NEG: vulnerability to different preprocessing methods, AICCC'21: 2021 4th Artificial Intelligence and Cloud Computing Conference, 2021

- Siniukov et. al Applicability limitations of differentiable full-reference image-quality metrics, accepted for publication in Data Compression Conference(DCC) 2023

- Siniukov et. al "NETFLIX VMAF no enchantment gain vulnerability to sharpness and contrast transformations", International Scientific Conference Lomonosov-2021

- Siniukov et. al "Limitations of applicability of differentiable reference indicators of image quality", journal "IPM named after M.V. Keldysh", 2022

- Siniukov et. al "Applicability limitations of novel full-reference image-quality metrics", accepted for publication in International Conference on Multimedia and Expo(ICME) 2023

- "Attacks on learning-based video-quality metrics: vulnerability analysis", in preparation

Conferences

- "Hacking VMAF and VMAF NEG: vulnerability to different preprocessing methods", Asia Digital Image Processing Conference 2021

- "NETFLIX VMAF no enchantment gain vulnerability to sharpness and contrast transformations", International youth scientific conference Lomonosov-2021

- "High-frequency high-voltage short time electric discharge in air", The 39-th Beijing Young Science Creation Competition

Awards

- The First Prize of Excellent Youth Science & Technology Innovation Project, The 39-th Beijing Young Science Creation Competition, first place

- The 2-nd place at the competition of scientific and technical schoolchildren works "Scientists of the Future", 11-th grade, MSU, 2018

- The 3-rd place in the All-Russian competition of schoolchildren scientific works "Junior", 9-th grade, MEPhI, 2017

- Olympiad "Kurchatov", prize-winner

- Olympiad "Phystech", winner

- Engineering Olympiad for schoolchildren, winner

- Olympiad of St. Petersburg State University, prize-winner

Additional education

- Stanford University Machine Learning Course, coursera.org/verify/MBCJY2ULUCLR

- Specialization "Deep Learning Specialization" DeepLearning.AI, coursera.org/verify/specialization/DVTU2Z5DTXTM

- Course Convolutional Neural Networks.Coursera., coursera.org/verify/3ED6ZW8BRPPK

- Course Neural Networks and Deep Learning.DeepLearning.AI., coursera.org/verify/VTBRB4UGE2UC

- Course Structuring Machine Learning Projects. Coursera, coursera.org/verify/3ED6ZW8BRPPK

- Course Sequence Models. Coursera. coursera.org/verify/9UPKTEMFFW3E

- Course Improving Deep Neural Networks: Hyperparameter tuning, Regularization and Optimization DeepLearning.AI., coursera.org/verify/FXL4V7HPRSZH

- Educational course on the basics of sports programming at the MISiS Research Technological University, 2018

- English Language Certificate: LTC. General English. Certificate of Attendance, 2018

- Course "Media data processing and compression methods", CMC MSU

- Course "Intelligent methods of video processing", CMC MSU

Skills

- Programming: Python(PyTorch, Tensorflow 2, OpenCV, CatBoost, pandas, CUDA OpenCV, SciPy, DEAP, SymPy, Keras, PyTorch Lightning, scikit-learn, numba), C++, C, MATLAB(Octave), NASM, Java

- Technical skills: Docker, git, ssh, sanitizers, Valgrind, profilers, Make, ffmpeg, VQMT, LaTeX

- Languages: Russian(Native), English(Advanced, IELTS: 7.0/9.0, passed at October 2022)