Intern, REQ24-943
Energy-aware adaptative streaming of the video chain

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Summary

In this internship, the objective is to adapt the behavior of the adaptative streaming system to have an impact on the energy consumption of the end-user device without compromising the user experience while rendering the video. This work shall impact the entire video streaming chain (i.e., from the headend up to the display) by modifying the various factors (e.g., bitrate ladder, paper [1]) of the different components (i.e., encoder, packager, …) of the chain.

The goal will be to review existing solutions [2, 3, 4], then investigate how to adapt the most promising adaptative streaming system to introduce an energy reduction factor, possibly developing a deep-learning or reinforcement learning based network. It will also be required to validate the principle in the entire video streaming chain. A benchmark will be realized to estimate the energy consumption gain and check that the balance between a high-quality user experience and energy reduction is possible.

[1] Telili, Ahmed, et al. "Benchmarking learning-based bitrate ladder prediction methods for adaptive video streaming." 2022 Picture Coding Symposium (PCS). IEEE, 2022.
[2] Menon, Vignesh V., et al. "Energy-Efficient Multi-Codec Bitrate-Ladder Estimation for Adaptive Video Streaming." *2023 IEEE International Conference on Visual Communications and Image Processing (VCIP)*. IEEE, 2023.
[3] Menon, Vignesh V., et al. "Energy-efficient Adaptive Video Streaming with Latency-Aware Dynamic Resolution Encoding." *Proceedings of the 3rd Mile-High Video Conference*. 2024.
[4] Menon, Vignesh V., et al. "JND-aware Two-pass Per-title Encoding Scheme for Adaptive Live Streaming." *IEEE Transactions on Circuits and Systems for Video Technology* (2023).

Duration: 5-6 months, starting January-April 2025

Responsibilities

- State-of-the-art and analysis of advantages/problems
- Implementation and documentation of a possible solution
- Evaluation and reporting of results

Qualifications

List minimum required qualifications, preferred skills, abilities, experience, and education

- Master 2
- Adaptative streaming (e.g., HLS, DASH), video coding and processing. Deep learning, reinforcement learning. C/C++, Python. PyTorch or an equivalent deep learning framework would be appreciated

Keywords: energy consumption, energy reduction, energy-aware adaptative streaming, vision quality metrics, machine learning (deep and reinforcement learning).

Expected Outcomes:
This internship will be expected to generate patents and publications. Software that demonstrates the feasibility and performance of the developed technique would also be expected

Location: Rennes, France

Mentors: Franck Aumont, Olivier Le Meur

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