Design and evaluation of media-stream based Video Quality Measurement Models for IPTV services

Mots clés :

- Directeur de thèse : ahmed MEHAOUA
- Co-encadrant(s) :
- Unité de recherche : Laboratoire d’Informatique PAris DEScartes
- École doctorale : École Doctorale Informatique, Télécommunications, Électronique de Paris
- Domaine scientifique principal: Divers

Résumé du projet de recherche (Langue 1)

The successful deployment of IPTV and TV on demand (TVOD) services over fixed and mobile networks requires a range of tools for measuring and monitoring video quality at different network locations and time scales. The impact of encoding and transmission impairments on the perceptual quality video streams is quite complex and depends heavily on the codec type and configuration, network dynamics and on end system characteristics. There are a variety of algorithms for subjective and objective video quality estimation but relatively few standards and a fair amount of confusion. The Video Quality Experts Group (VQEG) has been actively working on objective video quality assessment since 1997. VQEG has conducted intensive testing of various algorithms and the conclusion reached was a recent ITU-T Recommendation J.144 [6]. ITU-T J.144 does not actually specify a single algorithm but “provides guidelines on the selection of appropriate” techniques. J.144 does contain descriptions and test results for four full reference algorithms, and also included PSNR as a reference. The VQM algorithm from the US Government’s NTIA ITS lab achieved slightly better performance than the other algorithms listed. There are essentially two “models” for perceptual video performance measurement. • Full reference algorithms compare the output video stream to the input • Zero reference algorithms analyze the output only Full reference algorithms perform a detailed comparison of the input and output video streams. This is a computationally intensive process as it not only involves per-pixel processing but also time and spatial alignment of the input and output streams. Full reference algorithms can achieve good levels of correlation with subjective test data however can only be used in limited applications - for example in lab testing, pre-deployment test or troubleshooting. Zero reference algorithms are generally more suitable for in-service monitoring of video services as they can analyze live streams. This type of algorithm can consider fewer factors than a full reference algorithm however can be deployed in a much wider variety of scenarios (fixed and mobile IPTV services). A new class of algorithms called “Media stream based algorithms”, such as Telchemy’s VQmon/SA-VM, Psytechnics’ PVI and Mehaoua’s ServMon [1] analyze the IP stream and video transport protocols such as RTP/RTCP (time distribution of lost and discarded packets, jitter ...), to build up an assessment of video quality and expressing this as a perceptual video quality score. Telchemy’s algorithm is differentiated in its ability to analyze the time distribution of lost and discarded packets and to model the impact of transient IP problems on perceptual quality, based on their widely adopted VQmon technology. Mehaoua’s algorithm is focusing in active measurement of IP network performance metrics along the end-to-end delivery path to derive objective video quality assessments of MPEG-encoded video on demand applications over multiple IP and DVB network domains [1]. As far as no intensive video signal processing is required, these new video quality measurement algorithms are suitable for both mobile/handheld devices and for residential setup-boxes. Real-time video quality performance evaluation and conformance in a broad range of networks and applications are envisioned. Unfortunately, they are not standardized and further studies are required. The objective of this thesis is to analyse and compare the performance and complexity of existing stream-based video quality measurement models. Then, to propose, design and evaluate a new model for both IPTV (multicast) services.

Résumé du projet de recherche (Langue 2)

The successful deployment of IPTV and TV on demand (TVOD) services over fixed and mobile networks requires a range of tools for measuring and monitoring video quality at different network locations and time scales. The impact of encoding and transmission impairments on the perceptual quality video streams is quite complex and depends heavily on various uncorrelated parameters (the codec type and configuration, network dynamics and end-system characteristics, ..). There are a variety of algorithms for subjective and objective video quality estimation but relatively few standards and a fair amount of confusion.