AI in Video Analysis, Production and Streaming Delivery

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Abstract. Video technologies evolve steadily with the evolution of machine learning and artificial intelligence which use cloud platform and video transcoding for better video production, delivery and live streaming. AI has profound effect on media and film industry, from content delivery to viewer’s experience. AI serves the richer and realistic experiences in personalization of user experience for video production and analysis process. AI changes the fact of manual tasks and facilitates deep content indexing. Quality assessment becomes easier when AI scrutinizes the content. Personal and interactive video provides new delightful viewing experiences. AI generates new level of interactions at scene by dichotomizing the videos and builds more practical access methods within the content.

Keyword. Artificial intelligence; Digital content; Video production; Video quality; Streaming

1. Introduction

Artificial intelligence (AI) driven technologies like deep learning, machine learning and natural language processing are the next generation of transformational technologies for video analysis, production and streaming, emerging in the markets which can adapt, sense and act to improve the performance over data. Machine learning and deep learning can incorporate multi-layered data which identifies video pattern and classifies the information over time [1]. The growing usage of video service demands for more reliable video quality, production and streaming. AI can figure out specific content, autonomous clip generation, optimize playback video and align the advertisement and content based on viewer’s interest. For video image recognition, a metadata file is enhanced by scanning the content which may vary and recognize all descriptions to produce a full-text audio transcription within video clip.
2. Machine Learning in Encoding
Initially for encoding videos fixed bitrate ladder is used, regardless of the content type. Diverse groups of streaming data need to be processed differently. Considering different content in same trends result in videos poor quality with consumption of more bandwidth. Peak Signal to Noise Ratio algorithm picks the better solution in high level schema for encoding source file to manifold resolutions.

3. Machine Learning Smarter Move in YouTube Encoding
With millions of device uploading videos each minute, delivering preferable quality of video and image is considered to be great challenge in YouTube. YouTube builds a neural network that combine data from test encodes over video clips. Machine learning algorithm optimizes the uploaded clip from a mezzanine transcode to minimize bitrate ratio using encoding criterion. YouTube use machine
learning and neural network to envisage quantization points which create preferred target bitrate to obtain the act of a dual pass coding in a single pass. The outcome would be single encoding parameterizations used to encode each video clip.

4. Machine-Learning Applications in Streaming Technology
Bandwidth and round-trip time is a parametric indicator for network quality whereas stability and predictability is an indicator for video streaming.

Adaptive streaming algorithms adapt which video quality should be streamed during playback based on the current network and state of the device. For many viewers, video buffering is an unfortunate act even with the use of adaptive bitrate video for high quality video experience [4]. Many machine learning streaming tools, stream processing framework with sophisticated handling of late arriving data with data processing pipeline and dataset based computing support streaming framework with mini batch. Machine learning algorithm in streaming avoid playback and buffering issue by deploying neural network for making data driven decision.

5. Artificial Intelligence in Video Production
AI is poised in video creation and production which impact video editing, scriptwriting, cinematography and scoring. Through the AI ability of sense, reason, act and adapt AI becomes an in demand technology in video production. For example you tube and Netflix are deploying AI in countless video production and delivery. Many facets of video production and distribution method like editing, filming, clips selection and sharing can be handled by AI. Automatic filming can be done with the help of drones which does not need any human interference. Many automated editing tools like Quikstories can edit videos quickly and AI can monitor the videos shared in online. Computer Generated Imagery in video production makes the look more realistic.

6. AI in Media and Entertainment Industry
AI technology has been imposed in filming, editing and post production process. AI and ML can automate the content management task, audio/video sync, media operations and cut down on human errors. Many film companies are deploying AI in entertainment industry for designing advertisement, employing special effects and developing trailers. The media content producers are embracing AI and ML to enrich the efficiency and speed performance of media production.

7. Deep Video Analysis, Translation, Transcription and Tagging
Deep video analysis learns if there is any changes in the scene, location reference and other (speech, face, text) recognition which deepens the content nomenclature and suitable tagging of the content and enrich the exactitude of content linkage, search and relationship. With machine driven indexing and metadata tagging AI can vary the complete content management background with highly automated process [5]. Video translation with multilingual subtitles for manifold dialects and languages with multi lingual subtitles expand greater audience’s experience. Metadata and natural language processing explores the deep content analysis. The audio content can be transcribed to readable text with machine learning automation. For example Alexa and google voice which automatically transcribe the user voice by replacing the word with new dimension of appropriate and determined relevance. AI with supervised learning algorithm provides personalized recommendations with voice input and rich content metadata. AI enhance virtual assistance for better customer experience by understanding emotions and dialectal features.

8. Video Encoding and Delivery optimization
Adaptive bit rate (ABR) streaming stimulates the video streaming. With available bandwidth ABR encoding generates trivial portion of unique file into different bit rates. The fixed bitrate chunk file is enhanced by AI technology to scene based encoding. AI encodes video by determining the needed compression level and optimal compression parameter by identifying the intricacy of scenes across
quality metrics [6]. Even at lower bitrate/bandwidth AI can engender sophisticated encoded streams which transform the way of offering unremitting videos to growing viewers for watching video. AI is also refining online media player performance by augmenting bitrate based on viewer location, network congestion, infrastructure metrics and bandwidth details.

Fig 3. AI video encoding

9. Visual Recognition
AI in facial and object recognition identifies object and individuals with the changes in time in the still images and videos. The visual processing reaches the highest level of accuracy with the machine learning algorithm in processing the large amount of data variation. AI analyzes the scenes by computing a symbolic representation of the scene content after the still images and videos have been processed to obtain specific features [7]. Many techniques from AI and machine learning play an important role in many aspects of visual perception, content editing and automatic content creation.

10. Anomaly Discovery
In past few years, online video acquisition led to a remarkable growth in multimedia databases superfluous. YouTube, Facebook and other online nets have created limitless chances and shape many individuals and media to become content creators and extent mass audiences. Currently, the quantity of video and images generated and accessibility to terrific amount of video for every second has reached to great extent which makes it impossible to monitor the anomaly content creation [8]. Google’s cloud API service generates countless effect to tag content aptly.

11. Digital Content Fingerprinting
AI based fingerprinting technology empowers content creators to get more control on their copyright content by fingerprint for identification process, tracking and monitoring across multichannel distribution. Content fingerprint extract the distinctive features of digital content along with metadata. It defines the video content by comparing fingerprint in the database storage and takes proper action for contravention and unauthorized distribution. YouTube embrace the copyright policy which authorizes original content creator to confiscate formerly uploaded copyrighted work and avert newly uploaded plagiarized content.

12. Post Production
After all the footage has been captured, the post-production process begins. AI automates the creative processes for scene selection, visual design, sound effects, video segmentation, script writing and fan
engagement. AI enhances script proofing, edit video footage, scene sequence, sound track and effect and offer multiple scene performance.

Fig 4. AI in production process

13. Quality Assessment
PSNR and MSE are video quality comparison tools based on pixels that do not reflect quality degradation. The three video quality assessment techniques are full reference, reduced reference and no reference.[9] Manual based visual analysis has accuracy challenges. AI and machine learning is shifting the way by empowering non-reference based video quality assessment [10].

AI enhances widespread characteristics sets and offer near real-time video quality assessment by learning from error patterns which bring unique efficacy in decreasing content release timelines.

14. Conclusion
Artificial Intelligence and Machine Learning has impending influence on anything and everything. AI and ML technology has its own unmapped terrain and difficulties but it is placed for greater goals with incomparable proficiencies. The emergent tendency of video usage offer video services insistence with effectual and consistent video quality assessment and analysis techniques. AI has been widely used in video production, analysis and screening which takes the media industry to next level in filming and production. AI in media and entertainment Industry is not far behind in systematizing its workflow processes. The amount of structured and unstructured content and videos has been uploaded in online, grows exponentially where AI driven methods empower those content and offer the chance to explore creative and interactive process.

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