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香港城市大學
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# A Joint Machine Learning and Game Theory Scheme for Rate Control in Video Coding

Communications & Information

Computer/AI/Data Processing and Information Technology

Consumer Electronics

Digital Broadcasting, Telecommunication and Optoelectronics

## Opportunity

In video encoding, rate control determines how many bits are allocated for each frame during video compression. Most current encoding schemes use the Rate-Distortion (R-D) model, which trades off quality gains against the additional storage required. This requires accurate modeling of R-D relationships for Coding Tree Units (CTUs) to achieve coding efficiency. To enhance bit allocation optimization at CTU level in High Efficiency Video Coding (HEVC), the invention proposes a joint advanced machine learning and game theory modeling framework for the R-D model prediction and bit allocation optimization, respectively. This offers much better rate control performances, including superior bit rate accuracy, R-D performances, quality smoothness and buffer control results, which would greatly improve the practical video encoding and decoding performances and visual experiences in video transmission and multimedia communication systems.

**IP Status**
Patent granted

Technology Readiness Level (TRL) ? 3

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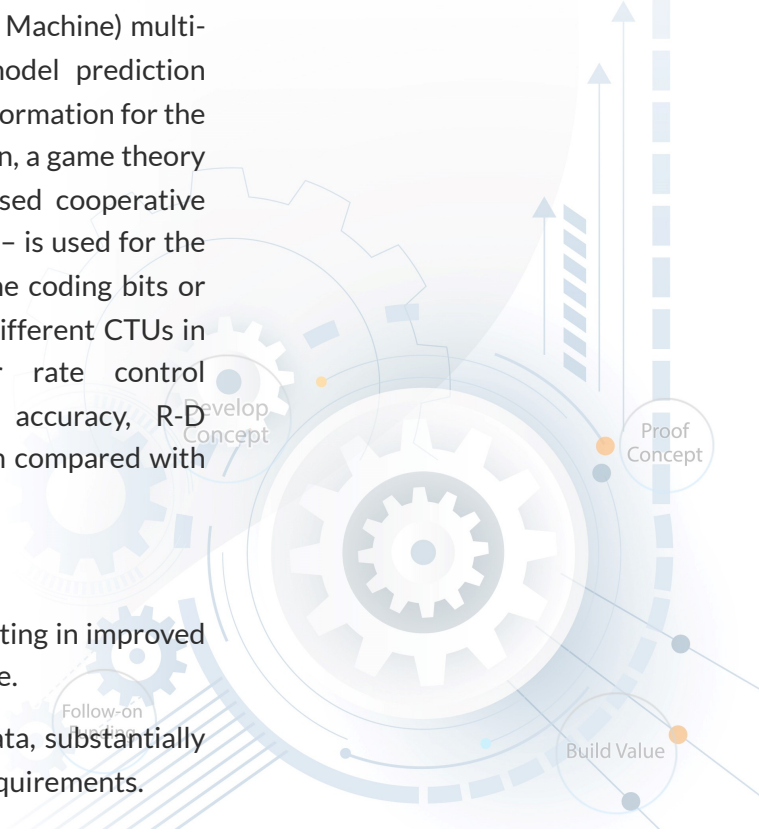
## Technology

Machine learning technique – using a SVM (Support Vector Machine) multi-classification scheme – ais used to improve the R-D model prediction accuracy for inter-frame CTUs by exploiting the potential information for the R-D relationships hidden in the video coding data. In addition, a game theory modeling approach – applying a multiple R-D models based cooperative bargaining game utilizing a Nash Bargaining Solution (NBS) – is used for the resource problem in video coding where the resource is the coding bits or communication bandwidth to be efficiently distributed to different CTUs in each frame. Experiments demonstrate the superior rate control performances of the proposed method on bit rate accuracy, R-D performances, quality smoothness and buffer control, when compared with other state-of-the-art one-pass rate control methods.

## Advantages

- More efficient CTU level bit allocation optimization, resulting in improved video coding performance, giving a better video experience.
- More efficient compression of large amounts of video data, substantially reducing the storage and communication workload and requirements.



## Applications

- Real-time video streaming applications, such as cable television (TV) programs, video-on-demand (VOD), live TV and videos over Internet.
- Real-time video chat/conference on computers or portable devices.
- Personal video cameras.
- Other video transmission and multimedia communication systems.