FLORIDA ATLANTIC UNIVERSITY

COLLEGE OF ENGINEERING & COMPUTER SCIENCE

announces the

Ph.D. Dissertation Defense

of

Rashad M. Jillani

for the degree of

DOCTOR OF PHILOSOPHY (PH.D.)

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EE405, Engineering East

777 Glades Road

Boca Raton, FL

DEPARTMENT: Computer & Electrical Engineering and Computer Science

DISSERTATION TITLE: "Low Complexity Scalable Video Encoding"

CHAIR OF THE CANDIDATE'S PH.D. COMMITTEE:
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ABSTRACT OF DISSERTATION

Low Complexity Scalable Video Encoding

In real-time multimedia systems, the coding performance of video encoders and decoders is limited by computational complexity. This thesis presents research work to develop techniques to manage computational complexity of H.264/AVC and SVC video encoders. These techniques aim to provide significant complexity saving as well as a framework for efficient use of SVC.

This thesis investigates experimentally the computational complexity of MB coding mode decision in H.264/AVC video encoder. Based on machine learning techniques, complexity reduction algorithms are proposed. It is shown that these algorithms can reduce the computational complexity of Intra MB coding with negligible loss of video quality.

We develop a general framework that applies to SVC and use this framework to adapt SVC bitstream by employing the low-complexity video encoding along with the input of video streaming constraints in order to adapt the bitstream. The proposed SVC based framework uses both objective low-complexity video encoding techniques and subjective saliency based video adaptation resulting in optimal use of network bandwidth.

The approaches described in this thesis can not only reduce computational complexity of a video encoder, but also can manage the trade-off between complexity and distortion. These proposed algorithms are evaluated in terms of complexity reduction performance, rate-distortion performance and subjective and objective visual quality by experimental testing.

BIOGRAPHICAL SKETCH

Born in Faisalabad, Pakistan
M.Sc. 2001, IIU, Islamabad, Pakistan

QUALIFYING EXAMINATION & PUBLICATIONS

Time in Preparation: 2007—2011

Qualifying Examination Passed: Fall 2006

Selected Publications:

- R. Jillani, U. Joshi, C. Bhattacharyya, H. Kalva, and K. R. Ramakrishnan. "Video Coding Mode Decision As A Classification Problem", *Proceedings of SPIE/IS&T Visual Information Processing and Communication*, San Diego, USA, January 17-21 2010.
- U. Joshi, R. Jillani, C. Bhattacharyya, H. Kalva, and K. R. Ramakrishnan. "Speedup Macroblock Mode Decision in H.264/SVC Encoding Using Cost-Sensitive Learning", *Proceedings of the IEEE International Conference on Consumer Electronics*, Las Vegas, USA, January 11-13, 2010.
- R. Jillani, and H. Kalva. "Low Complexity Intra MB Encoding in H.264/AVC", *Consumer Electronics*, IEEE Transactions on, vol.55, no.5, pp.277-285, February 2009.
- H. Kalva, P. Kunzelmann, R. Jillani, and A. Pandya. "Low Complexity H.264 Intra MB Coding," *Proceedings of the IEEE International Conference on Consumer Electronics*, Las Vegas, USA, January 9-13, 2008.
- R. Jillani, C. Holder, and H. Kalva. "Exploiting Spatio-Temporal Characteristics of Human Vision for Mobile Video Applications" *SPIE Optics Photonics 2008, Applications of Digital Image Processing XXXI*, San Diego, CA, Aug 2008, Invited Paper.
- G. F. Escribano, R. Jillani, C. Holder, H. Kalva, J. L. Martinez Martinez, and P. Cuenca. "Video Encoding and Transcoding Using Machine Learning", *In Proceedings of the 9th Intl. Workshop on Multimedia Data Mining: held in conjunction with the ACM SIGKDD 2008 (MDM '08)*, ACM, New York, NY, USA, pp. 53-62.
- R. Jillani and H. Kalva. "Scalable Video Coding Standard", in *Encyclopedia of Multimedia*, B. Furht, Springer US, 2008, pp. 775-781.