ERCIM fellowship Programme
Final scientific report

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Host Organisation	Fraunhofer Institute for Telecommunications, Heinrich Hertz Institute

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I – SCIENTIFIC ACTIVITY DURING YOUR FELLOWSHIP

Fraunhofer HHI has recently made significant strides in video coding with the introduction of Versatile Video Coding (VVC), standardized as ITU H.266. This cutting-edge video coder surpasses its predecessor, H.265 (High Efficiency Video Coding, HEVC), by offering a remarkable 50% improvement in compression efficiency while maintaining the same perceptual quality. However, this enhanced compression efficiency has led to increased complexity on the encoder side.

The VVC encoder software, known as VVENC, is primarily implemented in C++ and is openly available at https://github.com/fraunhoferhhi/vvenc. To further investigate the complexity of VVENC, our research focused on conducting a hotspot analysis. Subsequently, we examined various tasks that could potentially be offloaded independently to a field-programmable gate array (FPGA).

The Embedded Systems Group at HHI has developed a low-latency Network Attached Accelerator framework. Leveraging this framework, we successfully integrated the VVENC software with the FPGA accelerator socket. The compute intensive tasks are being offloaded to the FPGA. The corresponding control signals and data are being sent from VVENC to the FPGA memory. The FPGA accelerator reads the data from the memory, processes it and writes back to the FPGA memory. Once the processing is complete, the VVENC retrieves the data from the FPGA memory and the encoding continues.

II – PUBLICATION(S) DURING YOUR FELLOWSHIP

"Hardware Acceleration of Multi-Transform System in VVC Encoder"---pending

III – ATTENDED SEMINARS, WORKHOPS, CONFERENCES

"Complexity Analysis and Speed-Up Evaluation of the VVC Encoder"--- pending
Will be communicated soon to DASIP-24 Conference

IV – RESEARCH EXCHANGE PROGRAMME (REP)

I have attended two ERCIM member institutes for my Research Exchange Program:

1) REP #1

Institute: Norwegian University of Science and Technology (NTNU Norway)

Department: Department of Electronic Systems

Location: Trondheim, Norway

Coordinator: Kimmo Kansanen (Professor) and Roger Birkeland (Researcher)

Dates: 8-12, May 2023

Activities and Experience:

I selected the Department of Electronic Systems at NTNU for my Research Exchange Program (REP) due to its reputation as a top research institution in my field of work. During my time there, I had the opportunity to attend their weekly departmental meeting and present my research work. I am thankful for the engaging discussions that took place, exploring potential collaborations with the department. Additionally, I had the chance to visit various laboratories within the department and engage in discussions about potential future collaborations.

2) REP #2

Institute: Foundation for Research and Technology – Hellas (FORTH)

Department: Computer Architecture and VLSI Systems (CARV)

Location: Heraklion, Crete, Greece

REP Coordinator: Angelos Bilas (Professor)

Dates: 3-7, July 2023

Activities and Experience:

The CARV lab houses a talented team dedicated to FPGA implementations. On my first day, they graciously invited me to deliver a presentation on my research work. Following that, they proceeded to showcase their own work and exhibited the impressive prototypes they had developed over time. It was a truly enriching experience to witness first-hand the demonstrations of their prototypes. During our discussions, we explored the potential for future collaborations, fostering an exciting prospect for our partnership in the near future.