CMSC714 FINAL PROJECT PROPOSAL

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1. PROPOSAL

Automated detection systems for detecting people and vehicles is important in border security and surveillance. Enemy detection is strategically useful to prepare their attack and terrors. Many different algorithms have been suggested for detecting people and vehicles in border area using different types of sensors systems. Among them, non-image-based sensor is suitable for low power embedded systems.

Our previous work [1] provides feature level fusion algorithms using acoustic and seismic sensors. In this algorithms, original data are divided into multiple windows, and we extract features from each window. Then, features from two different modalities are concatenated, and SVM scores for each window are computed based on these concatenated features. Then, we accumulate these SVM scores to make ALFFS fusion score, and this fusion score is used for a binary classification. Figure 1 describes this algorithm.

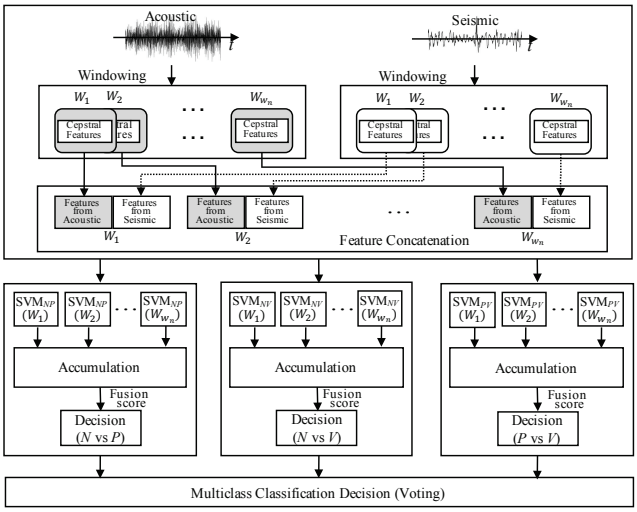

Fig. 1: Fusion architecture using ALFFS [1].

Based on this algorithm, we developed dataflow graph actors applications using C for ALFFS algorithms in our latest work [2]. Here, LIghtweight Dataflow Environment (LIDE) [3] is employed. LIDE is a tool for design and implementation of dataflow application, and we designed dataflow graph elements and dataflow-graph based applications. However, in this work, even if we use a number of windows, our program is only running in sequential, and we didn't consider any type of parallel processing. Thus, we would like to accelerate this dataflow application using Message Passing Interface.

Firstly, we plan to use OpenMP to parallel the processing of independent data segments. Input tokens in different windows can be assigned to different processors. For example, 1st processor can process data processing for 1st window (feature extraction, feature concatenation, and SVM score computation). 2nd processor may can processes 2nd window. Then, performance might be improved. Secondly, we might be able to apply OpenMP to optimize those computation kernels, like actors in the dataflow graph . For example, `for` loops in feature extraction actor can be optimized.

Then, we plan to distribute the tasks to multiple devices. We will cluster multiple embedded systems into 1 cluster with the help of MPI. Although we may expect that there is a tradeoff here because communication between multiple embedded systems might not be fast, we still hope to gain some speed up through appropriately balancing workloads between nodes.

2. REFERENCES

[1] Kyunghun Lee, Benjamin S. Riggan, and Shuvra S. Bhattacharyya, "An Accumulative Fusion Architecture for Discriminating People and Vehicles using Acoustic and Seismic Signals," in *Proceedings of IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, New Orleans, USA, March 2017, To appear. pre-publication version available online from http://www.ece.umd.edu/DSPCAD/papers/lee2017x2.pdf.

[2] Kyunghun Lee, Benjamin S. Riggan, and Shuvra S. Bhattacharyya, "An optimized embedded target detection system using acoustic and seismic sensors," in *Proceedings of 25th IEEE European Signal Processing Conference (EUSIPCO)*, August 2017, Submitted.

[3] C. Shen, W. Plishker, H. Wu, and S. S. Bhattacharyya, "A lightweight dataflow approach for design and implementation of SDR systems," in *Proceedings of the Wireless Innovation Conference and Product Exposition*, Washington DC, USA, November 2010, pp. 640–645.