



UAV-Based Intelligent RF Spectrum Sensing and Modulation Classification

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Unmanned Aerial Vehicle-based RF spectrum sensing and RF modulation classification are advanced techniques in wireless communication and signal intelligence. Drones equipped with RF sensors can capture and analyze signals in any given area, providing valuable insights for applications such as spectrum management, security, and reconnaissance. They efficiently cover large areas and hard-to-reach locations, making them ideal for real-time spectrum analysis. This allows for the detection of unused frequencies, improving spectrum utilization and mitigating issues like congestion and interference. RF modulation classification identifies the modulation scheme of captured RF signals, such as AM, FM, QAM, and PSK. Accurate classification is crucial for understanding transmitted information and is essential in applications like surveillance, electronic warfare, and cognitive radio systems. As drone technology and RF signal processing algorithms evolve, their capabilities are expected to grow, expanding applications in both civilian and military domains.

The present work proposes a field deployable system which utilizes open source LimeSDR module to log signal data and this logged data is transferred and loaded onto the model running on the Xilinx MPSoC [2] for data inference. A CNN based model is used for modulation classification role in the Vitis AI environment using the DeepSig RadioML 2018.01A dataset[1]. The dataset has been used to obtain I/Q values for different modulation types at different SNR values. The predictions made by the proposed CNN model gives us an approximate estimation of the type of modulation detected at the SDR Rx. Initial development focused on training the model to learn the dataset for ease of differentiating between various intercepted modulation types, gradually the model has been further extended to learn to classify a mixture of modulation types present in the incoming signal. The Vitis AI software from Xilinx converts the model into an .xmodel file and this is used to run inference on the MPSoC unit.

1. Over-the-Air Deep Learning Based Radio Signal Classification, IEEE JOURNAL OF SELECTED TOPICS IN SIGNAL PROCESSING, VOL. 12, NO. 1, FEBRUARY 2018

2. Real-time Automatic Modulation Classification using RFSoc, 2020 IEEE International Parallel and Distributed Processing Symposium Workshops (IPDPSW), New Orleans, LA, USA, 2020