DATASHEET

Radar Waveform Classification

Example Design

DESCRIPTION

The Doppler effect is a frequency shift or wavelength change in a reflection signal when a target moves or makes a change in a relative distance to an observer. While a bulky motion of an entire body part of the target generates the Doppler effect, its micro-movements of detailed structure can also create micro frequency shifts, which is called the micro-Doppler effect. This micro-Doppler signal reflects fine movements of the target, such as vibration, rotation, tumbling, or coning, etc., and these movement are unique and have certain patterns depending on objects or their motions.

Radar waveform classification example design is built to recognize unique micro-Doppler signatures of a target using a Convolutional Neural Network (CNN) model. It trains a probabilistic model to learn specific patterns or features of a target over prelabeled data set. It recognizes a target with such signatures easily based on the trained CNN model. A CNN is a popular method to be used for object recognition or classification of two-dimensional data formats, such as images, so the example design is intended to recognize a spectrogram of the target as input for an inference.

The example design accepts raw reflection signal data in time domain as input and produces a classification result based on a convolutional neural network model. The classification sequence has two steps to process: spectrogram and inference. Firstly, it converts reflection signal into a spectrogram using a short time FFT, where micro-doppler patterns appear. These motions are not deterministic, but rather probabilistic having certain patterns that is hard to be formulated clearly with an existing method. Then, the pretrained CNN model infers a target from these patterns.

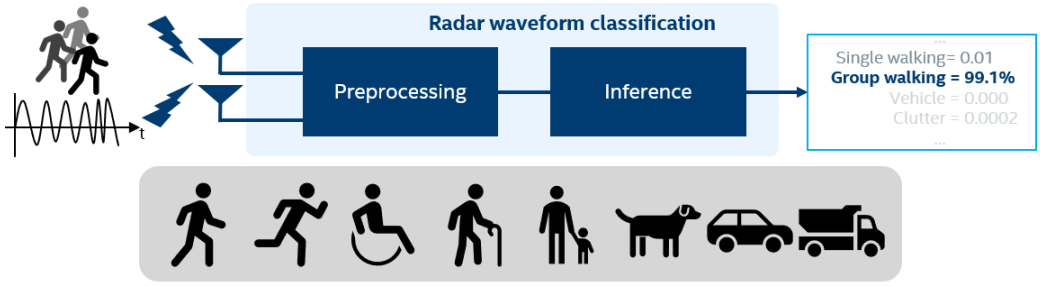
The CNN model used in the inference engine is trained using CAFFE, an open-source deep learning framework. Intel® Distribution of OpenVINO™ toolkit optimizes the trained model to import to the inference engine running in Intel CPU or Intel® Arria®-10 FPGA. The classification sequence runs on CPU and/or FPGA.

FEATURES

- Micro-Doppler classification
- Real-Time Radar waveforms recognition
- Pre-trained CNN model for 96W×513H×3D data in 7 classes
- Inference of CNN model on Intel® Arria®-10 FPGA and Intel® CPU using an Intel® Distribution of OpenVINO™ toolkit
- Demo on Intel® Arria®-10 FPGA Development kit

APPLICATIONS

- Autonomous vehicle
- Surveillance radar for military
- Robotics



Target object examples

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