Modelling pulse timing patterns with a GMM/HMM-framework

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2011-06-20

Abstract

The aim of thesis is to investigate the possibility of classifying pulse timing patterns from RF-signals using a model based framework. The increased prevalence of stochastic signal sources, as well as the rapidly increasing amounts of data available, motivates the need to apply pattern recognition algorithms to classify such signals. The thesis investigates the applicability of GMM/HMM-techniques to this problem on a dataset of simulated generic radar pulse repetition interval (PRI) data. The choice of model type, size of model, initial model parameters and HMM topology are discussed. A two-step process is suggested; first using a GMM to model the overall PRI distribution, followed by an ergodic infinite duration tied HMM to relate the time dependence in the pattern to the GMM components. A prototype has been constructed, which illustrates how the GMM/HMM-framework facilitates non-cooperative identification of pulsed RF-signals. The prototype has been tested on simulated data from 91 fictitious classes of PRI patterns, yielding a high rate of correct classifications.