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Narrow-band signal classification using Deep Convolutional Neural Networks

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With vast amounts of data collected every night by telescopes like Allen Telescope Array, there is a need for a real time system that can accurately distinguish between signals of interest from radio frequency interference. Seti Institute and IBM jointly organized a code challenge and hackathon in June 2017 to encourage efforts towards this goal using machine learning techniques [1].

In this paper, we present our approach based on Convolutional neural networks for classification of narrow band signals. By converting the radio signals into 2D spectrogram image, the problem of signal classification can be transformed to as image classification problem. Deep convolutional networks are currently the state-of-art techniques in image classification. We demonstrate the effectiveness of CNN technique by using a simple Alexnet [2] network with 5 convolutional layers. Our approach achieved a score of 0.21 based on the logloss metric in the hackathon. In real world scenarios, telescopes can receive multiple types of narrow-band signals simultaneously. We also extend our work to detect simultaneously occurring signals with multiple labels and initial results for the same will be presented in this paper.

References

1.https://github.com/setiQuest/ML4SETI

2. Alex Krizhevsky, Ilya Sutskever, and Geoffrey E. Hinton. Imagenet classification with deep convolutional neural networks; In Advances in neural information processing systems, 2012, pp. 1097-1105.