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Advanced Operating Systems: Project Report

Embedded Neural Network

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Abstract

In this document we will discuss about the implementation of a sound classifier on a STM32 board.

1 Introduction

1.1 The Problem To Solve

1.2 Why Neural Networks?

For recognition and analysis of sound, AI techinques are used because of the complexity of the computations and the amount of noise present in the environment. Another important issue is that instances of the same sound have high variability due to different (yet omogeneus) sources. For example, think about word recognition: an effective application should recognise a word even if spoken by different people.

1.2.1 Which kind of NN?

Here we are using a sequential feed-forward neural network. Since we are trying to distinguish two differnt sounds, the NN is a classifier which output has one-hot codification. This simple model is expected to work because of the simplicity of the problem and the caracterization of the two sounds. It gets as input the FFT of a time window.

1.2.2 How to implement NN on a board?

The STM32cube.ai allows to compile a pre-trained neural network into a library to be called in the code.

1.3 Acronyms and Definitions

- **AI:** Artificial Intelligence
- **NN:** Neural Network
- **FFT:** Fast Fourier Transformation

2 Design and Implementation

2.1 Board Programming

2.1.1 Issues

2.2 Network Training

2.3 Testing

3 Experimental Results

4 Conclusions

4.1 ...

4.2 Possible Use Cases

4.3 Future Improvements

5 Some LaTeX Examples

5.1 Sections

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5.2 Comments

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Use the table and tabular commands for basic tables — see Table 1, for example. You can upload a figure (JPEG, PNG or PDF) using the files

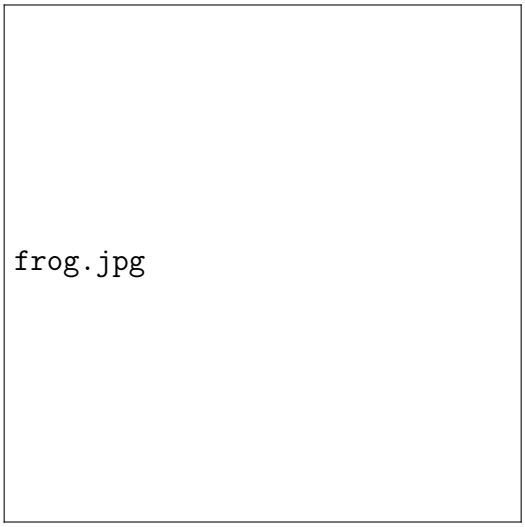

Figure 1: This is a figure caption.

Item	Quantity
Widgets	42
Gadgets	13

Table 1: An example table.

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5.4 Mathematics

LaTeX is great at typesetting mathematics. Let $X_1, X_2, \ldots, X_n$ be a sequence of independent and identically distributed random variables with $\mathrm{E}[X_i] = \mu$ and $\mathrm{Var}[X_i] = \sigma^2 < \infty$, and let

$$S_n = \frac{X_1 + X_2 + \cdots + X_n}{n} = \frac{1}{n}\sum_{i}^{n} X_i$$

denote their mean. Then as n approaches infinity, the random variables $\sqrt{n}(S_n - \mu)$ converge in distribution to a normal $\mathcal{N}(0, \sigma^2)$.

5.5 Lists

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