Classification of time signals by CNN using spectrogram

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# Introduction

Convolutional neural network (CNN) is a deep learning algorithm used to process the data of image. It is commonly used in computer vision as a classification technique to distinguish different objects. On the other hand, spectrogram is a representation method used to present three-dimension measured signals in two-dimensional diagram.

Based on the dataset provided by Professor Pech in the module Computational Intelligence at Frankfurt University of Applied Sciences (FRA-UAS), the goal of this project is to classify the reflected signals of different objects using CNN and spectrogram.

# Literature review

## Gabor Transformation

Based on the provided dataset which is the set of analog signals in time domain, Gabor transform is used to convert them to time-frequency representation. Basically, Gabor transform filters the signals with a Gaussian window and Fourier Transform will be then applied to the filtered signals. The following formula is the applied filter as discussed:

Em chiu thua :’( Giup em cho nay voi, hong hieu gi :v

As the time increases, the signal dataset is acquired with the corresponding time from the window length until it reaches the end of the window. The whole process will generate the spectrogram of the signals to be used later as the training set, and also to test the model accuracy.

## Convolutional Neural Network

The concept of neural network or artificial neural network is commonly known as a combination of different layers connected to each other to make decisions based on different types of input. Biologically speaking, the neural network is a technique that mimics approximately how a naturally-living brain functions. Each layer contains various different nodes acts as a system of neurons that can interconnect between layers. Besides, dependent on the importance of each specific neuron, or node, a factor called weight is introduced to bias for the purpose of the system. These layers are commonly known as the hidden layer.

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On going...

(Viet Nguyen)

# Methodology

## Overview

## Gabor Transform and Creation of Spectrogram

(Toan Truong)

## Convolutional Neural Network configuration

(Toan Truong)

## Graphical User Interface GUI

(Hai Pham)

A user-friendly GUI was created to implement the experiment of Gabor transform as well as CNN classifier. The app is named “GUI.mlapp”. The figure below shows the GUI of this project.

[FIGURE OF GUI HERE]

Figure [NUMBER] shows the GUI is divided into three sections:

* The first section is located at the top left corner of the frame. This one is used for loading training data files and create spectrograms for each sample in the training data.
* The section which is used for training and validating the data is right under the first section.
* The last section is situated at the left panel of the GUI. This section indicates the predicted results of test data files.

The following is a short manual instruction in order to run the GUI application:

* Step 1: First and foremost, user needs to load the training files by pressing the button “Browse File” as shown in figure [NUMBER] -> FIGURE WITH BROWSE FILE BUTTON RED . Currently, the training dataset includes three files “Data Object 1”, “Data Object 2”, “Data Object 3” which are located inside folder “dataset”. User can choose one file, two files or three file files at the same time for training purpose. After choosing training files, the names of all chosen files are illustrated in the table to help the user can check it again.
* Step 2: Press the button “Create Spectrogram” to generate all spectrograms from the “Data Object” files. All the images are stored in folder “trainingData”, which is created automatically by Matlab. There is a LED in the lower area of the “Create Spectrogram” button to illustrate status of the process. As depicted in the figure [NUMBER] -> FIGURE WITH LED ORANGE AND CREATE SPECTROGRAM, the LED shows orange and the status indicates “Processing” while the program is running. After creating spectrograms, the LED changes to green and the status also alternates to “Finished”.

# Experiment

## Experiment’s result

(Riyad)

## Result on Given Test data

(Riyad)

# Conclusion

# Further Development

(Toan Truong)

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