

Localization with activity recognition and particle filter

1st Bergauer Philipp

TU Graz

Graz, Austria

philipp.bergauer@student.tugraz.at

2nd Halici Ömer Faruk

TU Graz

Graz, Austria

halici@student.tugraz.at

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I. INTRODUCTION

The Localization was split into two parts, the first part was an Activity recognition and the second part was the localization Algorithm with the Particle Filter. The Activity recognition was implemented with an k-Nearest Neighbor(k-NN) algorithm. It was used to classify if the user is moving or not.

II. ACTIVITY RECOGNITION

The mobile phone has many sensors. Some of them can be used to track the activity of a person. After collecting sensor data the patterns in the data can be retrieved and can be used to classify between activities e.g jogging,running, walking.

A. Tensorflow approach for Convolutional Neural Network

Our first approach was to use the popular tensorflow framework from Google. The idea was to train and write the code in python and export a tensorflow model which can be used by our mobile phone. The training data was taken from the Wireless Sensor Data Mining group [1]. We decided to use a CNN network because it can be used to analyze interesting features in the data set. The error rate for the training data was very low. Only 15 % were misclassified. The export to the android device worked too but in the end it did not work as accurate enough. The problem was that our dataset and our own sensor data generated from our mobile phones were different so the model misclassified most of the activities wrong. After days of debugging and fixing errors we came to the conclusion to go along with the K-NN approach [2].

B. K-NN approach

First of all the K-NN algorithm is one of the simplest and most used classification algorithms. The classification of an object/class uses the majority vote of its neighbours. There are many decisions to be made before implementing the K-NN. First of all which K should we take. The K stands for the number of neighbours to be taken in account. It should

be an odd number. In our case it was 21. The calculation of the distance is another point to think about. We decided to use the euclidean distance for our K-NN. The formula of the euclidean distance:

$$D(w_i, v_i) = \sqrt{\sum (w_i - v_i)^2} \quad (1)$$

The euclidean distance is easy to program and is very efficient. Afterwards we thought about the features to use for the data set and the window size. We took the same features as for our CNN. The mean for each axis of the accelerometer values, the max peaks in each axis, the min peaks in each axis and the variances of each axis. In addition one record contains 20 samples too. The sample rate can be adjusted in android so we took the sampling rate `SENSOR_DELAY_FASTEST`. According to its name it should be the fastest one. The window size are 20 samples. The sampling rate is dependant on the hardware in the mobile phone, so it is hard to give a window for 20 samples in seconds but it should be approximately 50ms. The reference dataset was taken with the `SensorHandler`. These classes take the samples and write them in a text file. In our main activity we can click on the generate data button and generate data for our classification as shown in ??.

For the classification we needed classes. We choose 3 activities as classes. Before you begin to format your paper, first write and save the content as a separate text file. Complete all content and organizational editing before formatting. Please note sections ??-?? below for more information on proofreading, spelling and grammar.

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LOCALIZATION

The preferred spelling of the word “acknowledgment” in America is without an “e” after the “g”. Avoid the stilted expression “one of us (R. B. G.) thanks ...”. Instead, try “R. B. G. thanks...”. Put sponsor acknowledgments in the unnumbered footnote on the first page.

Particle Filter

Please number citations consecutively within brackets [1]. The sentence punctuation follows the bracket [2]. Refer simply to the reference number, as in [3]—do not use “Ref. [3]”

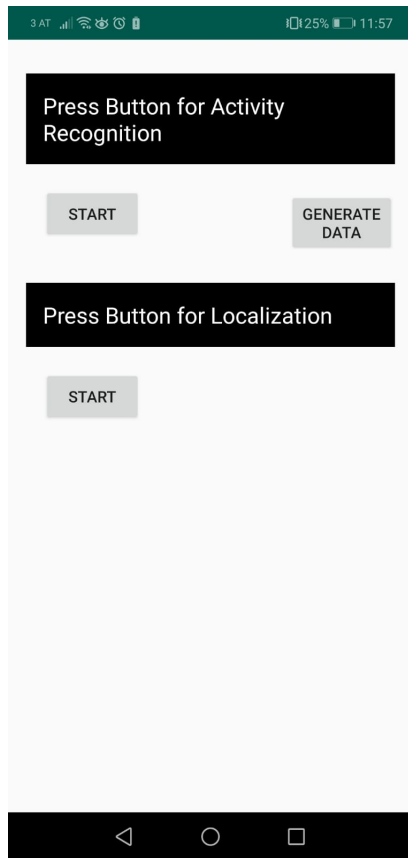


Fig. 1. MainMenuActivity of the application

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For papers published in translation journals, please give the English citation first, followed by the original foreign-language citation [6].

Optimizations particle filter

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