Machine Learning for IOT - Homework 1

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Exercise 1

At the beginning the .csv file, contains 4 columns but based on the required columns for TFRecord we create a timestamp from date and time columns and after converting these two columns we can create our TFRecord dataset. Then we code the normalization function and use the data in the technical data sheet to find the minimum and maximum values for temperature and humidity to use in the normalization function. In the final part of the code, we demonstrate the values for the size of the TFRecord dataset file which will be shown by the script at the end of the code. The size of the TFRecord files is available in table 1. Also, must mention the for POSIX we used int64 because other data formats such as float since it is not usable due to different values and samples for collecting the time in POSIX format. For humidity and temperature, we used int64 before normalization and float after the normalization, since after the normalization procedure the output won't be an integer. As we can see the size of the file is smaller before the normalization so it's safe to say it is easier to move and store the file without the normalization procedure. But in the cases which normalization is required, it's better to be applied after creating the TFRecord file.

Size before Normalization (Bytes)	Size after Normalization (Bytes)
2378	2552

Table 1

Exercise 2

For this exercise, we first read the audio files using TensorFlow library. after that we need to specify the required information for STFT and MFCC such as frame length, frame steps etc. based on the instructions in the homework file, afterwards we implement the code to calculate the STFT. Based on the STFT result, we compute the spectrogram and use some of its properties to subsequently compute the MFCC. The obtained execution time is the time for the so called slow MFCC. Then we must experience with different values for the number of bins to achieve the required threshold but also, we have considered a tradeoff between the execution time and the SNR value since they are related to each other, and we don't want to violate the constrains. Also, for the value of frame step and frame length we need to convert the values from milliseconds to number of samples (for that matter we first convert them to second and the multiply them by the sampling rate) because considering TensorFlow's documentations, we need to specify the inputs like that. We ran a script to find the right value for the variable that represents the number of bins. The output of fast MFCC based on different values for the number of bins is shown in table 2.

Number of bins	Average execution time (ms)	SNR (dB)
13	17.956	10.46

Table 2