ACSE-5: Assignment one - Climate Change Focus: How can we predict temperature changes?

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In this assignment, a numerical model was implemented to predict a city’s global temperature increase every January 2020, 2030, and 2050. The Linear Regression method was adopted for its better predicting capabilities. The data for Oxford is obtained from the Met Office[1].

**1. Code Design**

We design the code to only read in data files in the format given by the Met Office. This means tab delimiters are only 3 spaces (not 4) and reading in methods had to be specially designed. Column titles had to be detected as well as header descriptions. Single and double array pointers were used to store column data for its efficiency.

In investigating what modelling/hypothesis function was best to use, several methods were hard coded to model the function in the Regression class due to not knowing which data column was needed for modelling (which had to be found via trial and error).

**2. Code Structure**

The program is split into the main class, Data class, and Regression class. This organised the program logic and enabled more efficient coding. The Data class handled reading in data, data manipulation, and storing relevant data into its respective object. The Regression class contained the linear regression method and stored the weights of the hypothesis function. The main class utilised the other two classes, but in addition had its own methods to solve the actual problem of forecasting the temperatures.

**3. IO Handling**

The data log was read in using read\_data(), storing it into a vector. The vector is then converted into a double pointer array and any meta-data is extracted. As mentioned before, the reader has been tailored for this specific data file, so it will ignore rows with any specific words (e.g. PROVISIONAL) and abnormal values (\*, ---).

For outputting data, we use the file stream and iostream methods to output the column data into a .dat file. Which can be read by Gnuplot for plotting. A file pipeline for Gnuplot is coded into the main file.

**4. How to execute**

On the Github repo, move into the Debug folder and run the Coursework1.exe file. A data file should already be inside the folder.

**5. Future Improvements**

If given more time, the Data methods would be generalised to allow better data manipulation of column data (like python pandas lib) enabling better user experience. Furthermore, giving an option for people to select their own year to predict the future temperature and choice of city would also improve user experience.

[1] Met Office. (2019) Oxforddata.txt. Available from: https://www.metoffice.gov.uk/pub/data/weather/uk/climate/stationdata/oxforddata.txt [Accessed 22nd Jan 2019]