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EK 125

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Our Planet Needs Help

Introduction

One of if not the largest threat to animals, plants, and even humans is simply brushed aside in everyday life. Global warming is a huge problem and many people either are unaware of it or just do not believe in it. Before this project I knew it was bad but after completing my goal, I didn't realize how bad it really was. This project is to inform those who are misinformed, stubborn, or just unaware of how quick our earth's temperature is rising. More specifically, our Machine Learning project predicts the temperature of the globe in its entirety as well as 5 major countries. We coded it so that we can type in almost any year and it will allow us to predict things such as critical temperatures where wildlife can get hurt or even go extinct.

According to nrcd.org, global warming is the buildup of CO2 and other greenhouse gasses which trap and contain the heat and radiation within our atmosphere. During the past few decades, the rate of the temperature increase is reaching dangerously high. Scientists are trying to keep 2040 under a 1.5 change in celsius. Many sources confirm that a 1.5 to 2 C increase is deadly to the ice caps and can put many animals in danger. This machine learning tool shows real evidence for global warming and can predict how long it will take to reach these numbers. Since change in temp is relatively gradual throughout the years, it can be seen as unimportant but this project helps really show the actual changes over the years and what the future could look like.

Global Data

My partner and I first started off attempting to graph and examine the trend over the past couple of hundreds of years. We had initial trouble because the first half of the dates did not work with dashes (/). To fix this, we took two of the same datasets each with two different formats so that the first half of one could be spliced with the second half of the other. We ended up getting data like this:

```
OverallGlobalTemps2
```

OverallGlobalTemps2 = 2172×2 table

	dt	LandAverageTemperature
1	01-Jan-1835	2.5510
2	01-Feb-1835	2.9670
3	01-Mar-1835	4.5070
4	01-Apr-1835	7.7690
5	01-May-1835	10.1710
6	01-Jun-1835	12.0070
7	01-Jul-1835	13.1290
8	01-Aug-1835	12.3220
9	01-Sep-1835	9.9420

```
%to scrub OverallGlobal(:,1) = []
```

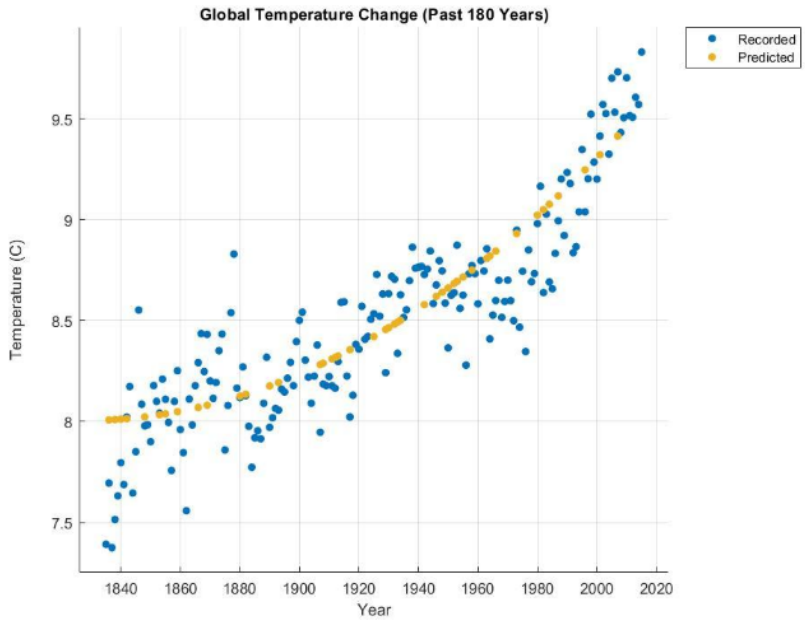
Since the data before these points had large inaccuracy ranges, we chose to scrub them leaving just these years and the dates. Another problem that we ran into was that the data was displayed in per month instead of year. We struggled to find a solution to including trying to graph the points with each month included, however, we found a formula. We used a nested for loop that would loop in a series of 12s which would average all of the months into years. It would also skip the earlier problem of the date and create a new column of the dates that would be easier to read.

```
for j = 1:181
    if j == 1
        a = 1;
        b = 12;
    else
        a = (12*(j-1)) + 1;
        b = 11 + a;
    end
        for i = a:b
        num = num + OverallGlobalTemps2{i,2};
        end
    ave = num/12;
    num = 0;
    date(j) = j + 1834;
    var(j) = ave;
end
Goodietable69(:,1) = array2table(date');
Goodietable69(:,2) = array2table(var')
```

Goodietable69 = 181×2 table

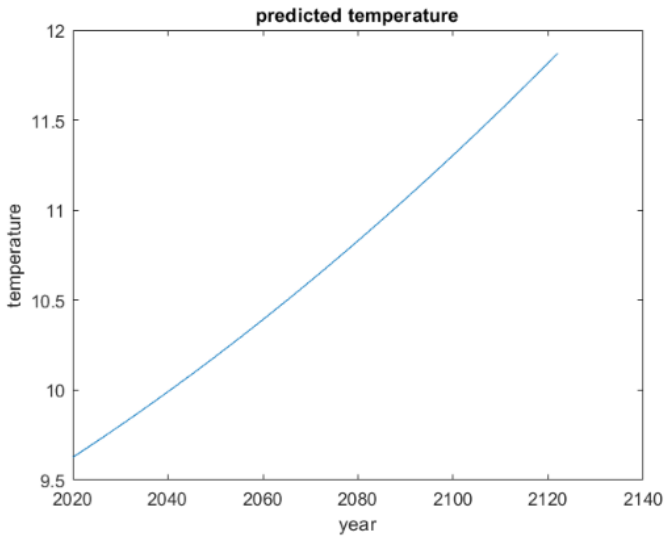
	Var1	Var2
1	1835	7.3925
2	1836	7.6958
3	1837	7.3757
4	1838	7.5149
5	1839	7.6322
6	1840	7.7963
7	1841	7.6882
8	1842	8.0228
9	1843	8.1737

Using this table of the year and its corresponding average temperature, we were able to use the linear regression. I initially thought that the relationship was going to be linear as I knew global warming was in process but I was very alarmed to see that it is in fact exponentially changing as seen below.



In the linear regression menu, the quadratic always seemed to fit the graph and was logically the best one. There were some regressions that had a lower RMSE, however, their shape either didn't make sense or when predicting a future date using that regression, the temperature would lower instead of higher. This left the quadratic function to fit the best whilst making the most sense.

As our program would only calculate one year at a time, we wanted to see if we could create a graph of predicted values. We decided to make this graph from 2020 to 2120 to see how much the temperature would increase over the next 100 years.




```
xlswrite('Actualdata.xlsx',temp);
yeet = readtable('Actualdata.xlsx');
yfit1 = trainedModel14.predictFcn(yeet);
fprintf('The Predicted Temp is %0.2f C',yfit1);
```

```
The Predicted Temp is 10.72 C
```

This is pretty scary to see how even without a century the temperature can change so drastically. Our model predicts that the temperature will change almost a whole 3 C within 100 years which is unheard of. This graph also asks for a date and when entering the year 2075, It predicts 10.72 C which by looking at the graph seems about right.

The Country Calculator

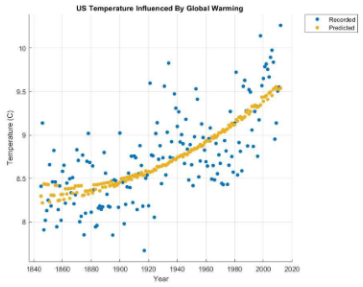
Our program only shows the temperature of the globe throughout the years but we wanted to have more variety so we chose the 5 main countries from the United Nations.

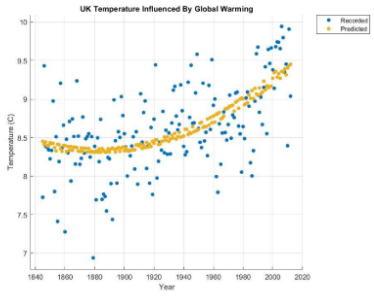
USdata1 = 168×2 table

	Var1	Var2
1	1845	8.4089
2	1846	9.1363
3	1847	7.9071
4	1848	8.0168
5	1849	8.1292
6	1850	8.2483
7	1851	8.6575
8	1852	8.1831
9	1853	8.4599

UKdata1 = 168×2 table

	Var1	Var2
1	1845	7.7257
2	1846	9.4319
3	1847	8.3870
4	1848	8.3738
5	1849	8.3414
6	1850	8.2249
7	1851	8.3337
8	1852	8.9750
9	1853	7.8002





Francedata1 = 168×2 table

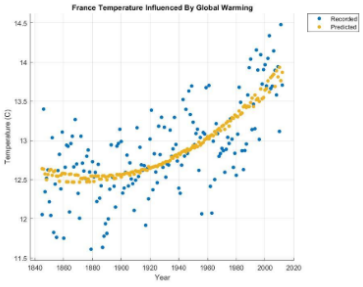
	Var1	Var2
1	1845	12.0541
2	1846	13.4008
3	1847	12.3455
4	1848	12.5166
5	1849	12.6246
6	1850	12.2175
7	1851	12.0427
8	1852	13.0356
9	1853	11.8262

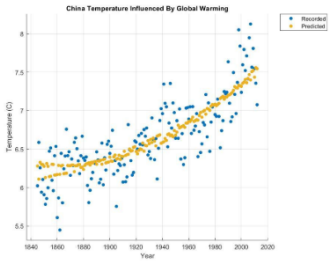
Chinadata1 = 168×2 table

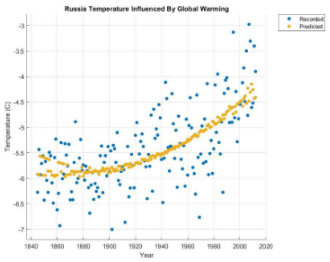
	Var1	Var2
1	1845	6.0230
2	1846	6.5875
3	1847	6.2571
4	1848	5.9397
5	1849	6.1048
6	1850	5.9072
7	1851	5.7828
8	1852	5.8575
9	1853	5.9976

Russiadata1 = 168×2 table

	Var1	Var2
1	1845	-6.2748
2	1846	-5.4339
3	1847	-5.9303
4	1848	-5.7083
5	1849	-5.5605
6	1850	-6.4265
7	1851	-5.6696
8	1852	-6.0397
9	1853	-6.2760



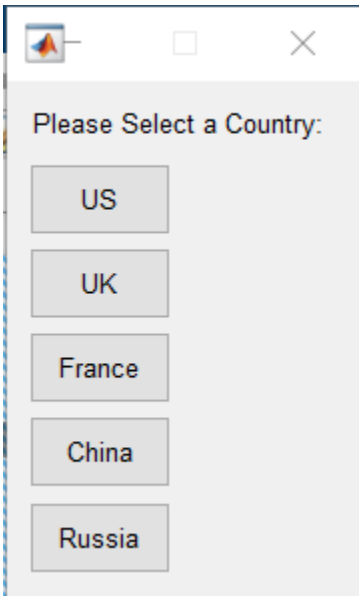




ussia Predictor

Each curve appears the same with them all fitting a quadratic function as shown above Also, using a menu function, the user can enter any one of the 5 countries, and then a year and it should predict it based on already observed temps.

```
num = 0;
var = zeros(1,168);
date = zeros(1,168);
for j = 1:168
    if j == 1
        a = 1;
        b = 12;
    else
        a = (12*(j-1)) + 1;
        b = 11 + a;
    end
    for i = a:b
        num = num + CountryData{i,3};
    end
    ave = num/12;
    num = 0;
    date(j) = j + 1844;
    var(j) = ave;
end
Francedata1(:,1) = array2table(date');
Francedata1(:,2) = array2table(var')
```



An example of this interaction would be the menu popping up, asking which country the user would like to know a future temperature. The user picks France. Then, the window asks the question of which year they would like to know about. The user enters 2089. The return of this would be:

```
The predicted temperature is 11.06 C
```

Overall, it is pretty clear to see that the world's temperature resembles an exponential-like function which just goes to show the immensely quick rate of global warming rising. Using our graph of the world's rate of increasing temperature, it will take around another 80 years to increase by 1.5 C which is much faster than previous centuries. According to NASA, the

temperature has been raised 1.18 C since 1880. If calculated correctly, between 80-100 years from now, the poles are going to start melting which then affects animal populations. This is a reason to start thinking about using renewable and clean energy as our world's destruction is already within our sights.

Works Cited

https://www.nrdc.org/stories/global-warming-101

https://climate.nasa.gov/

https://www.kaggle.com/berkeleyearth/climate-change-earth-surface-temperature-data