Weather Conditions and Climate Change

with ClimateWins

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Introduction

ClimateWin, a non-profit organisation based in Europe, are concerned with the increase in extreme weather events, especially in the past 10 to 20 years.

ClimateWin are looking to use machine learning to help better predict the consequence of climate change around Europe and, potentially, the world.

The Data

Data is collected from multiple different sources

- 18 different weather stations across Europe from 1800s to 2022.
- Hurricane predictions from The National Oceanic and Atmospheric Administration (NOAA) in the U.S
- Typhoon data from The Japan Meteorological Agency (JMA) in Japan

Data Bias

Temporal Bias

Data collection is from 1800s until 2022. Older records may no longer be relevant to current climate conditions

Location Bias

The data is collected from across Europe. This will not provide an accurate representation of weather condition worldwide.

Data Accuracy

Data collection methods have improved over the year. Older data may not be as accurate as current data.

Hypotheses

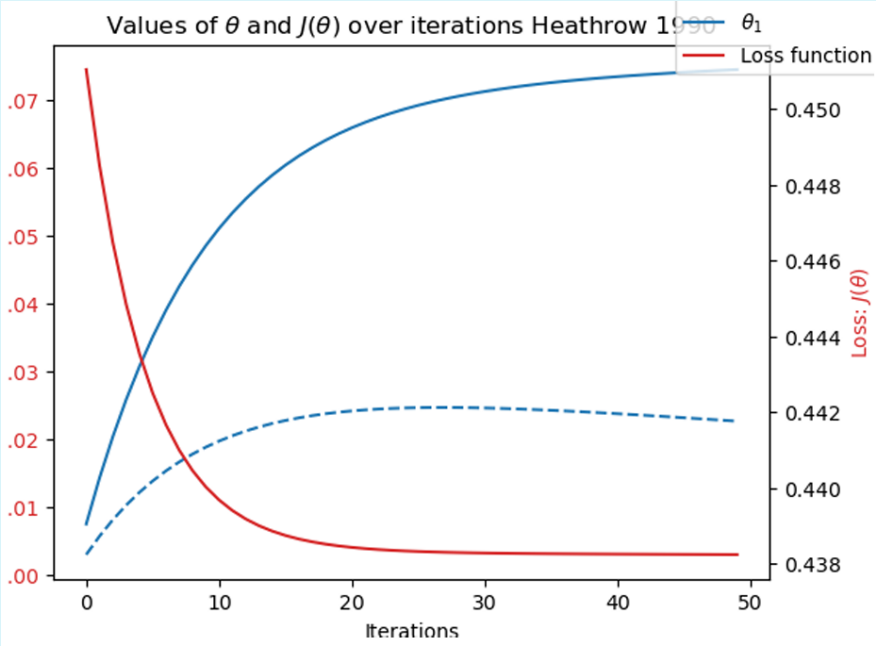
The machine learning algorithm will be able to accurately predict weather.

There will be a correlation between increase in temperature and extreme weather events.

The algorithm will be able to identify signs of climate change.

Optimisation

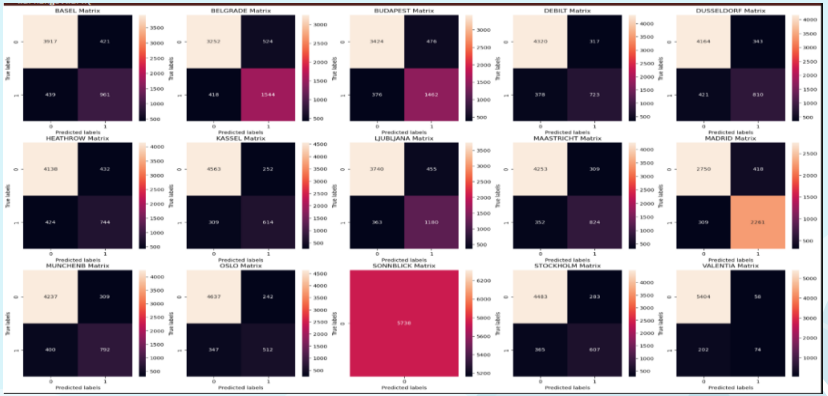
- Optimisation is the process of locating the global optimum of a dataset (the highest and lowest points).
- Gradient descent was used to optimise this data set.
- The parameters were adjusted to minimize the loss function and get the result close to 0.



K-Nearest Neighbour

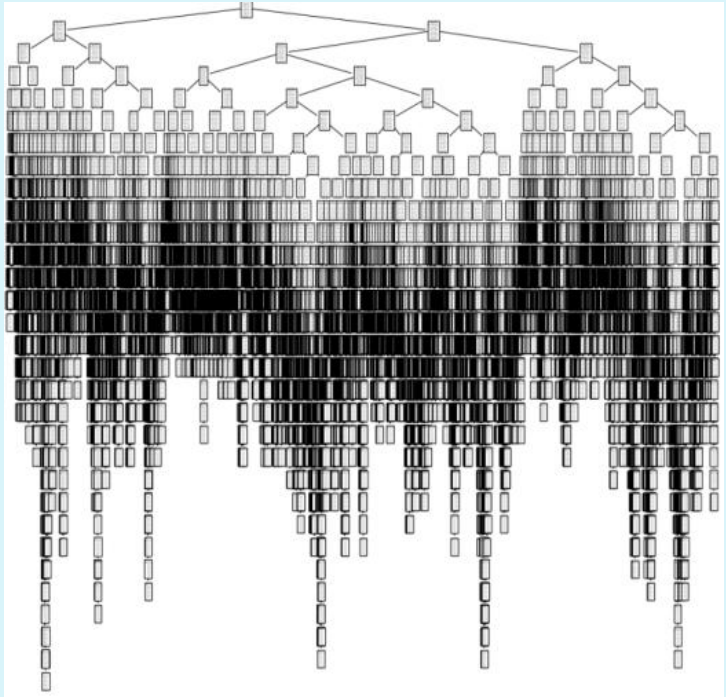
- N-Nearest Neighbour(KNN) calculates the distance between new data points and other data points to make a prediction.
- Predictions were conducted on 15 weather stations across Europe.
- The KNN model had an average accuracy rate of **88%**.
- To increase accuracy, the training model must include a varied dataset from a wider range of weather conditions.

Weather Station	True Positive	True Negative	False Positive	False Negative	Accuracy Rate
BASEL	3917	961	421	439	85%
BELGRADE	3252	1544	524	418	84%
BUDAPEST	3424	1462	476	376	85%
DEBILT	4320	723	317	378	88%
DESSELDORF	4164	810	343	421	87%
HEATHROW	4138	744	432	424	85%
KASSEL	4563	614	252	309	90%
LJUBLJANA	3740	1180	455	363	86%
MAASTRICHT	4253	824	309	352	88%
MADRID	2750	2261	418	309	87%
MUNCHENB	4237	792	309	400	88%
OSLO	4637	512	242	347	90%
SONNBLICK	5738	0	0	0	100%
STOCKHOLM	4483	607	283	365	89%
VALENTIA	5404	74	50	202	95%
				Average	88%



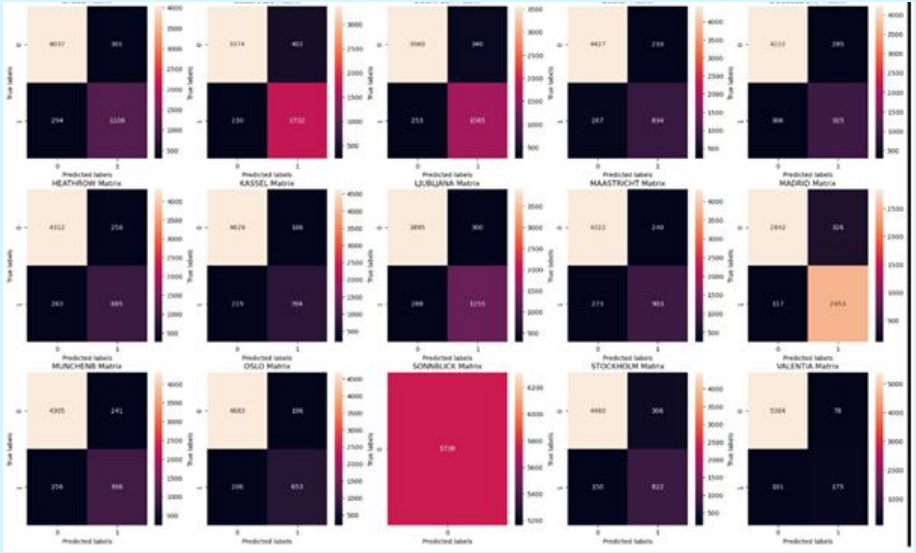
Decision Tree

- Decision tree uses a series of questions about the features of the data to make a prediction.
- The model has an accuracy rate of **96%.**
- The decision tree is extremely complex with multiple branches making is difficult to interpret.
- The model will most likely need to be pruned.



Artificial Neural Network

- Artificial Neural Network (ANN) is an supervised ML model which mimics the human brain process.
- The model consists of interconnected layers and inputs to make a prediction.
- Several tests were run to find the most optimum layer number, nodes size, iterations and tolerance.
- The maximum accuracy is **53%**.



Conclusion

Summary

- Different supervised ML methods were used to predict weather.
- The most accurate method is the Decision tree, followed by KNN
- Neither are perfect and adjustments need to be made e.g. pruning the decision tree.

Next Steps

- Use unsupervised ML algorithms to further improve prediction accuracy.
- Optimise the supervised ML models to improve results.
- Combined use of supervised and unsupervised algorithms predict weather events and monitor climate change.

Thanks!

Do you have any questions?

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