Analyzing Weather and Climate Change with ClimateWins

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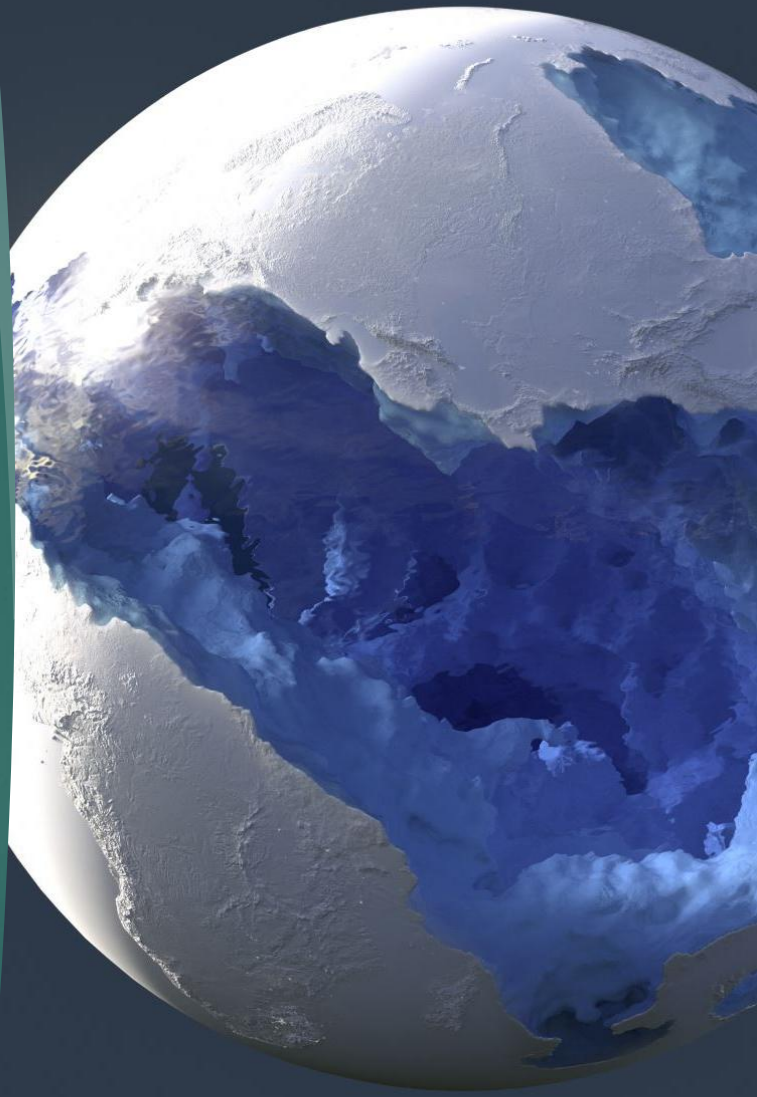
Introduction

- - ClimateWins wants to use machine learning to help guess the effects of climate change in Europe and maybe the whole world.
- - It is using hurricane data from NOAA (USA), typhoon data from JMA (Japan), global temperatures, and other weather info.



Hypothesis

- WE BELIEVE MACHINE LEARNING CAN GUESS FUTURE WEATHER CONDITIONS ACCURATELY.

- HOW WELL IT GUESSES DEPENDS ON THE LOCATION AND CLIMATE OF EACH PLACE.

- MACHINE LEARNING CAN FIND SIGNS OF CLIMATE CHANGE AND ITS BAD EFFECTS.

Data Set Info

- The data came from the European Climate Assessment & Dataset Project.

- It includes info from 18 weather stations across Europe.

- It covers a long time, from the late 1800s to 2022.

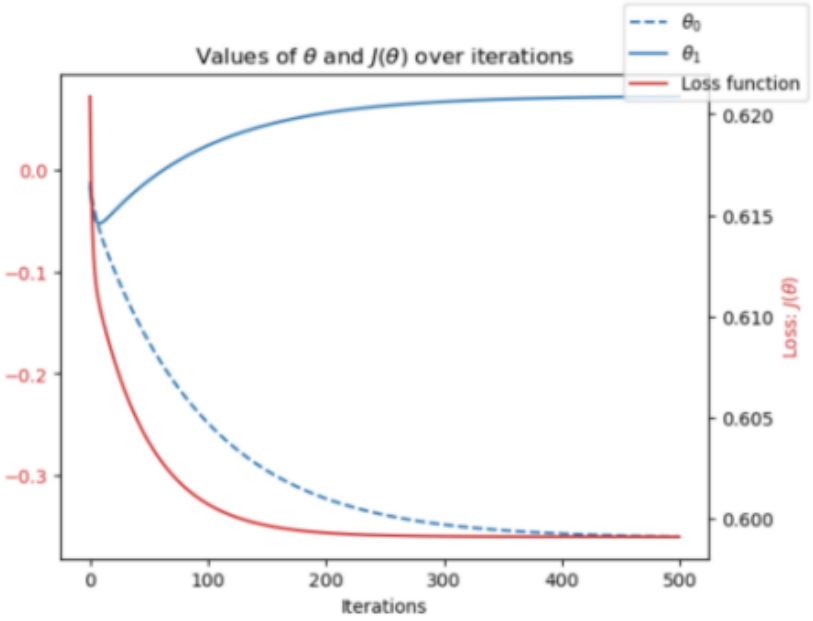
- Data includes temperature, wind, snow, sunlight, and more.

Data Bias & Accuracy

- - Older data might have mistakes since it was collected by hand.
- - Big areas have more data, which can make small places seem less important.
- - Since the data covers over 200 years, old info might not match today's weather.
- - All the data needs to be in the same format for fair use.

Data Optimization

- - We used something called Gradient Descent to make the data better.
- - Gradient Descent changes model settings to make errors smaller.
- - It keeps adjusting until the model gets closer to the best result.



Method 1: K-Nearest Neighbor (KNN)

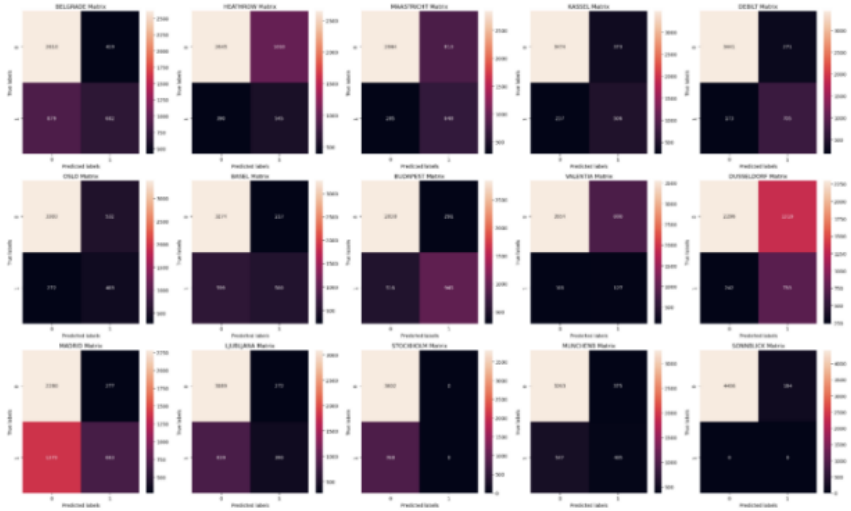
- - KNN guesses weather by looking at nearby data points and grouping them.
- - It had an average accuracy of 89%.
- - To improve, the model needs to include more different weather types and places.

Weather Station	Accurate predictions		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	96%
				Average	88%

Method 2: Decision Tree

- - A decision tree uses questions to make predictions.
- - The data goes through the tree based on answers.
- - Accuracy was about 64%.
- - It is hard to understand because the tree has too many parts.

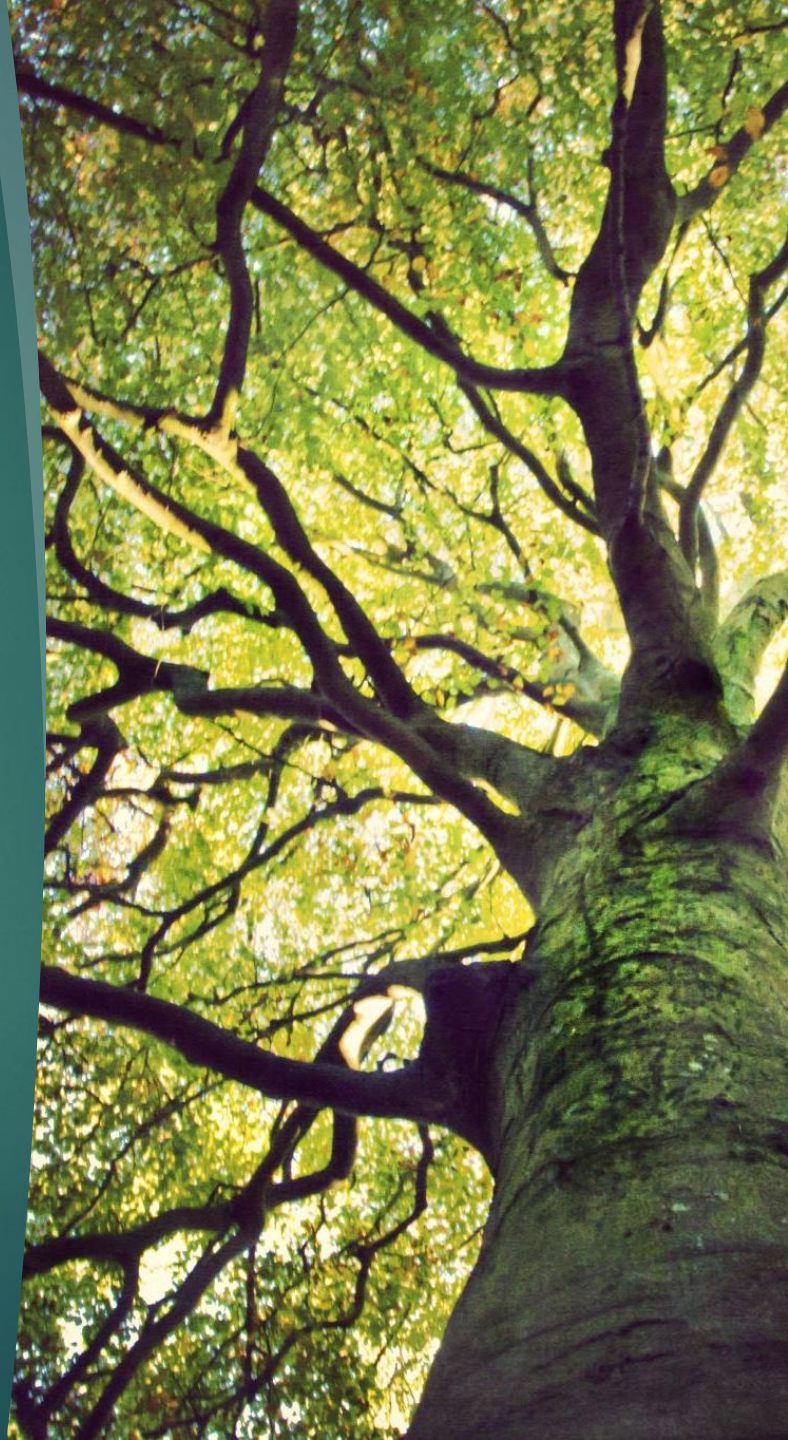
Method 3: Artificial Neural Network (ANN)



- ANN works like a brain. It learns patterns from data.
- It has layers of fake "neurons" that adjust to get better.
- We changed the size and number of steps in the layers.
- Best accuracy was 64%.
- The confusion matrix showed how many times the model was right or wrong.

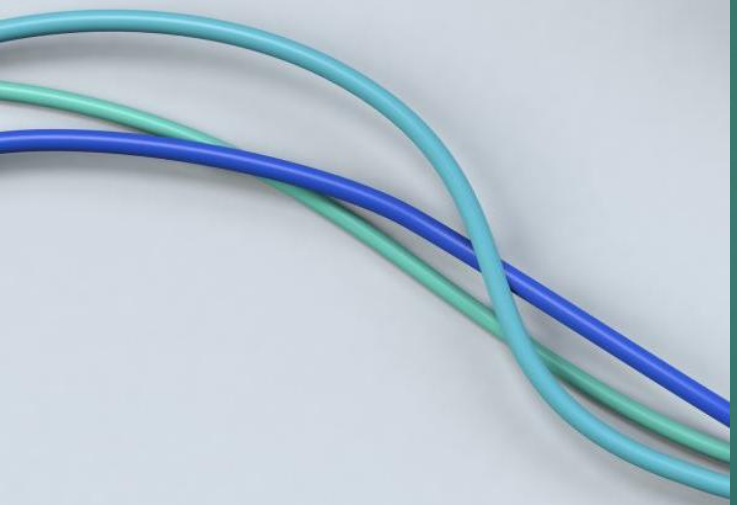
Algorithm Recap

- - Decision Tree is too hard to understand.
- - KNN gave the best results, with 89% average accuracy.
- - ANN is more powerful and works better for big and messy data.
- - Even though KNN had higher accuracy, ANN is better for complex weather patterns.



Summary

- - Machine learning can help predict weather. Some models reached 89% accuracy.
- - Accuracy changes depending on the location and weather in the area.
- - For example, Sonnblick predicted 5738 bad weather days. Madrid only predicted 2799.
- - It also helps spot signs of climate change.



Next Steps

- - Try other types of machine learning that don't need labeled data.
- - Add more kinds of data.
- - Keep testing and adjusting the models to improve them.
- - Use more weather stations to get better results.

Thank You

- For any questions, please contact:

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- Check out the full project on GitHub: https://github.com/jamestnanthikattu