Science AMA Series: We're team Wildfire AWARE, finalists of the NASA Europa Challenge and winners of the RCUK Entrepeneurship award. We built an app that can predict wildfires up to a week in advance and we're here to talk about our experience, AMA!

WildfireAWARE [1] and r/Science AMAs[1]

[1]Affiliation not available

April 17, 2023

Abstract

Hi! We're a group of Computer Scientists and Mathematicians working on an application to predict wildfires using machine learning and data analysis! We worked on the application part-time for 2 months, we were invited to Finland for the NASA Europa Challenge finals and we also won the Research Council UK's Smart Cities Entrepeneurship Prize! Currently, we're working with Greenpeace Russia to expand our application to several high risk areas in Russia, Brazil and Indonesia to hopefully help them prevent wildfires and save lives! We're here to talk about our experience, answer any questions people might have and talk about what we plan on doing going forward. Questions will be answered by team members Vishal Soomaney, Peter Jupp and Flinn Dolman, we will be back at 10 am ET to answer your questions, AMA! You can check us out at: http://wildfireaware.co.uk/app/ Proof: https://www.cs.york.ac.uk/news-events/news/news2017/nasa-europa-challenge/ edit: We really enjoyed answering everyone's questions! If anyone has any more questions, ideas or feedback, you can get in contact with us at wildfireaware@gmail.com . You can also watch us nervously talk about our app during the NASA Europa Challenge Finals here: https://www.youtube.com/watch?v=aNlA6yVuTYw A big thanks to the r/science mods for helping us arrange this AMA!

the WINNOWER

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WILDFIREAWARE R/SCIENCE

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You can check us out at:
http://wildfireaware.co.uk/app/
Proof:
https://www.cs.york.ac.uk/news-events/news/news2017/nasa-europa-challenge/
edit: We really enjoyed answering everyone's questions! If anyone has any more questions, ideas or feedback, you can get in contact with us at wildfireaware@gmail.com . You can also watch us nervously talk about our app during the NASA Europa Challenge Finals here: https://www.youtube.com/watch?v=aNlA6yVuTYw
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Thanks for coming to talk with us! How do you imagine government officials using your app? Do you imagine them gathering resources based on predictions when there is no fire yet?

asbruckman

Hi, Thanks for the question! We imagine government agencies using our application to take preventative measures to reduce wildfire occurrence. These measures can range from simply increasing firefighter presence in high risk areas to taking steps to raise the humidity in the area. We are in talks with several firefighters to come up with more specific preventative measures based on the exact forest conditions. Patrick Hogan from the NASA Ames Research Center has also helped us get in contact with some US based firefighting agencies regarding this.

The UK currently uses a pretty old Fire Danger rating system:
https://www.metoffice.gov.uk/public/weather/fire-severity-index/#?

and winners of the RCUK Entrepeneurship award. We built an app that can predict wildfires up to a week in advance and we're here to talk about our experience, AMA!, *The Winnower* 4:e150746.67063 , 2017 , DOI: 10.15200/winn.150746.67063

tab=map&fcTime=1507460400&zoom=5&lon=-4.00&lat=55.74

Australia mainly uses algorithms developed in the 1980s, these are based on equations of best fit: https://en.wikipedia.org/wiki/McArthur_Forest_Fire_Danger_Index

We see evidence of government agencies slowly trying to update their systems but at the moment we don't believe that any use machine learning based systems. Due to this we hope that once we further develop our application and surpass an 80% prediction accuracy, government agencies might consider using our predictions when determining what actions to take and how to spread out their resources.

I've never even heard of your app, but that sounds amazing! How many wildfires have you successfully predicted, and what measures are taken once you think you know where the next wildfire will happen?

JustNotGrunge

Haha, hopefully you'll hear about us more over the next few years :D We're still working on a system to automatically cross-reference our predictions with actual wildfire occurrence but this remains experimental. At the moment we're checking whether we predicted a fire correctly manually so we don't have an accurate count. That said, we have tested our application on a standardised dataset containing 6 months of California weather data and we had a 74.8% prediction accuracy. In regards to what measures are taken, we are in talks with Greenpeace Russia, Greenpeace Brazil and Greenpeace Indonesia regarding collaboration once we expand our application to their areas. The idea is for their volunteer firefighters to use our application to take measures to prevent wildfires before they occur rather than start firefighting efforts after a fire starts. This can involve simply increasing the presence of firefighters in high risk areas, evacuating people nearby or ideally taking measures to increase the humidity in the forest. We are in contact with several firefighters as well and our hope is that one day our application will be able to provide specific wildfire prevention measures for a region based on our predictions and specific forest conditions.

Well, that sounds amazing! 1) So, (a bit detailed) how does your app work(like the algorythms, etc)? 2) I'm thinking about an undergraduate education at computer science/engineering. Do you hace some advises? 3)What and how was the process of making this app?

Work you've done, it's plain awesome.

poyrazogluyigit

Thanks! 1) You asked for this to be a bit detailed so here goes :D

First we obtained 7 years of historical weather data, including Temperature, Humidity, Wind Speed and Rain data from around the US. We also obtained wildfire occurrence dates and locations. We standardised the data then applied Principal Component Analysis to it. We fed the output into a Support Vector Machine to train our model: http://scikit-learn.org/stable/modules/svm.html

We tested our model on a standardised dataset containing 6 months of California weather data and found that our model had a 74.8% predictions accuracy. We then used the Dark Sky API to automatically obtain daily weather data and a future 1 week weather forecast for all forest locations we're trying to predict a wildfire for. This data is used to automatically update a database containing the past 14 days of weather data and future 1 week forecast for every location. After this, the data in the database is fed into our model which provides us with a prediction in the form of a wildfire likelihood (percentage). This is shown on the application.

This is better explained in the presentation we did in Finland: https://www.youtube.com/watch?

v=aNlA6yVuTYw

To better visualise the data, you can see an older version of the system here: https://www.youtube.com/watch?v=CwL5mRKHpJg&t=3s

2) Computer Science is a great field that is constantly evolving. There's recently been ridiculous progress in Machine Learning, Blockchain technology, Internet Of Things and so on so it's a very exciting field to get into. Keep in mind that it's not for everyone and for all the fascinating modules you'll do, there will probably also be some that are essential but you find difficult or don't find too interesting. As long as you do some research before applying for your undergraduate education and work hard, we're sure you'll become a great Computer Scientist that gets to work on some really fun projects!

3) Once we built the team, came up with the idea and signed up to the competitions, it was pretty straightforward. Since we' just a 3 person team, we could just talk through Facebook messenger and write down our tasks for the week on Facebook. We all worked on each part of the application but generally there was one member in charge of each part of it. This way if we ever had any disagreements, the person in charge of that part of the app would get the final say. We're moving to a professional team organisation style now though. Throughout the project we all had either a full-time internship or university work to do so we could only really work on the project between 7:30 pm and midnight during weekdays. The weekends were generally when most of the magic happened. Basically, you wouldn't many updates between Monday and Friday but come back after the weekend and you'd barely recognise the app! :D

Obviously your app can not predict something like this where 30,000 acres burned because a teenager was messing with fireworks, but can it do anything about predicting the path the fires will take in a case such as this?

DickyD43

As you said, we unfortunately can't predict such accidents. We can however show where conditions are easiest for a fire to start if someone were to, lets say, drop a cigarette. Our application has a "Wind" option which will show you forecasted wind speeds and directions over the next 5 days for all forests where we're trying to predict wildfires. These can give you an idea of where a wildfire would spread were it to occur. Of course, there's several other factors that affect the path a fire would take were one to occur and we are working on getting access to relevant data so that we can eventually predict this with some accuracy. We're always looking for more ideas and feedback so please do let us know if you have any thoughts on how we can more accurately predict the path a fire would take!

Hello, thank you for doing this AMA! How exactly does your app predict wildfires?

How reliable is it?

Do you think it could be used at a global scale?

Hafornin

Hi! So we currently have a model trained using 7 years of temperature, humidity, wind speed and rain data from around the US. This was correlated with wildfire occurrence, standardised and fed into a Support Vector Machine: http://scikit-learn.org/stable/modules/svm.html We're currently working on implementing Air Pressure, Ozone levels, forest elevation and other factors into the model as well.

We're automatically obtaining daily weather data and future weather forecasts from the Dark Sky API

which sources this data from the NOAA. We're using this to automatically update a database containing the past 14 day weather average and the future 1 week weather forecast. This data is fed into our model to provide our predictions.

This is better explained in the presentation we gave whilst in Finland:https://www.youtube.com/watch?v=aNlA6yVuTYw

And you can better visualise how the data is being used in this video (slightly old now though): https://www.youtube.com/watch?v=CwL5mRKHpJg&t=3s

In regards to it's reliability, we tested the application on a standardised dataset containing 6 months of California weather data. Our model had a 74.8% prediction accuracy. So it's quite reliable at the moment, it can definitely be improved though and we're hard at work to surpass an 80% accuracy :D

Currently the application has only been trained using data from the US. Sadly it's quite expensive to get access to a large amount of high quality data and until quite recently we had no funding so we were personally paying for the data. We're managed to secure a bit of funding from the Research Council UK so we're now getting access to worldwide weather and wildfire occurrence data. We intend on it being ready to be used at a global scale by the end of the year!

What sort of algorithms do you have that predicts these wildfires? I imagine some sort of machine learning is involved looking at rain and temperatures but how do you do it?

thijser2

You guessed right! There's some machine learning involved, specifically we're using Support Vector Machines to train our prediction model: http://scikit-learn.org/stable/modules/svm.html

Currently our model is only looking at temperature, wind speed, rain and humidity data but we're working on incorporating air pressure, ozone levels and even forest elevation data in the near future. We've also been talking to the ESA to see if we can get access to some worldwide soil information.

At the moment, we're looking at whether using Ensemble Methods in the future would provide a greater prediction accuracy: http://web.engr.oregonstate.edu/~tgd/publications/mcs-ensembles.pdf

A similar question has been answered in more detail above. We also explain how we've done it in a bit more detail here: https://www.youtube.com/watch?v=aNlA6yVuTYw

And in even more detail here: https://www.youtube.com/watch?v=CwL5mRKHpJg&t=3s

Thanks for the question!

Have you ever thought about using this app for additional predictive purposes? Could the analytics used to predict wildfires also be used to predict something healthcare related, like an influenza outbreak?

Sheephurrrdurrr

Currently our model is trained using a Support Vector Machine: http://scikit-learn.org/stable/modules/svm.html

Support Vector Machines are already being used to do healthcare related analytics and predictions: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3092139/

That said, a lot of the factors that we are looking at, such as temperature, humidity, rain, wind speed

would affect the likelihood of an influenza outbreak as well so that's definitely an avenue worth exploring!

Hi, why are wildfires more common in your view, in the countries you mentioned?

Wagamaga

Hi there! That's a difficult question, there exist a large number of factors that affect wildfire occurrence. In places like Brazil and Indonesia, there tend to be seasons of consistently high temperatures and little rain around several forests. Soil type, Ozone levels, forest density and even elevation plays a part as well and of course global warming isn't helping.

It is our view that if government agencies took more and better directed preventative measure then wildfire occurrence in these countries could be greatly reduced!

Sadly, at the moment even very highly developed countries such as the US, Spain and Portugal get ravaged by frequent wildfires so it's not an issue that's limited to a few countries. With climate change, we're more likely to see perfect conditions for wildfire occurrence in even more countries. Just stopping fires isn't enough, they need to be prevented from starting in the first place!