

Wildfire prediction



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Disaster Response Hackathon

Powered by
Amazon SageMaker Studio Lab 





Inspiration

Many forest fires happen around the world. There are many investigations to detect fires in satellite images (*using colors, temperature changes, vegetation changes, etc...*).

But since we have a history of satellite images, I have thought to use the images prior to the start of the fire, to try to predict in which places a fire is most likely to start.



Step 1. Data collection



Wildfire dataset. 300-500m resolution.
Temporal Coverage from several years ago.

<https://firms.modaps.eosdis.nasa.gov/download/>

	latitude	longitude	brightness	scan	track	acq_date	acq_time	satellite	instrument	confidence	version	bright_t31	frp	daynight	type
0	-11.2690	-27.6022	310.5	1.7	1.3	2021-01-01	0007	Terra	MODIS	71	6.03	294.7	16.4	N	3
1	-6.4528	143.2207	307.0	1.1	1.1	2021-01-01	0101	Terra	MODIS	50	6.03	292.4	5.0	D	0
2	28.7351	9.7986	303.2	1.0	1.0	2021-01-01	0119	Aqua	MODIS	54	6.03	276.0	10.9	N	2
3	28.7368	9.7881	310.7	1.0	1.0	2021-01-01	0119	Aqua	MODIS	81	6.03	276.8	16.1	N	2
4	31.5913	5.9692	302.2	1.2	1.1	2021-01-01	0119	Aqua	MODIS	48	6.03	270.4	14.3	N	2
...
3090808	-32.6069	147.2451	306.6	1.5	1.2	2021-08-31	2357	Terra	MODIS	61	6.03	292.7	10.1	D	0
3090809	-32.1991	146.9268	304.8	1.6	1.2	2021-08-31	2357	Terra	MODIS	53	6.03	294.5	7.4	D	0
3090810	-32.6090	145.7355	304.1	1.8	1.3	2021-08-31	2357	Terra	MODIS	36	6.03	294.0	7.7	D	0
3090811	-32.1986	146.9203	312.9	1.6	1.2	2021-08-31	2357	Terra	MODIS	71	6.03	294.7	17.1	D	0
3090812	-38.1520	145.3238	304.3	1.5	1.2	2021-08-31	2358	Terra	MODIS	59	6.03	288.2	9.8	D	0

3090813 rows × 15 columns



Sentinel-2 is a satellite mission that provides **high resolution image of the Earth** (10m resolution), every 5 days.
Temporal Coverage from several years ago. <https://registry.opendata.aws/sentinel-2/>



Step 2. Data preparation

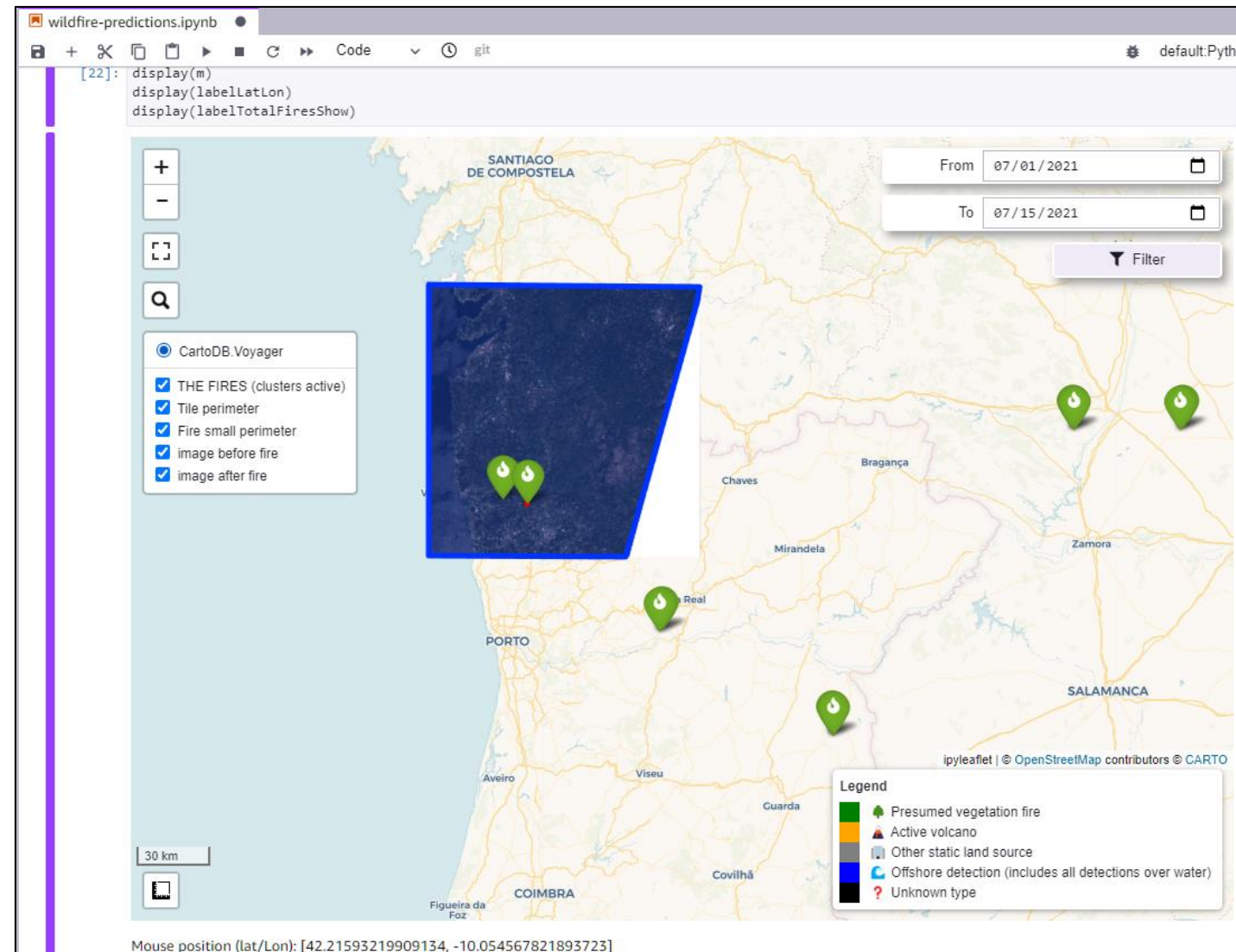
2.1. Exploring the data using an **interactive map**, with **filters by date**, **layers** and **popups**.

2.2. **Download and cut satellite images** of the moments before the fire starts. This will be **our dataset**. **Do it at scale automatically** (for many fires).

2.3. **Overlay** this satellite images on fire locations.

2.4. Convert images to **grayscale**.

2.5. Add images labeled as "**non-future fireable location**" to the dataset.





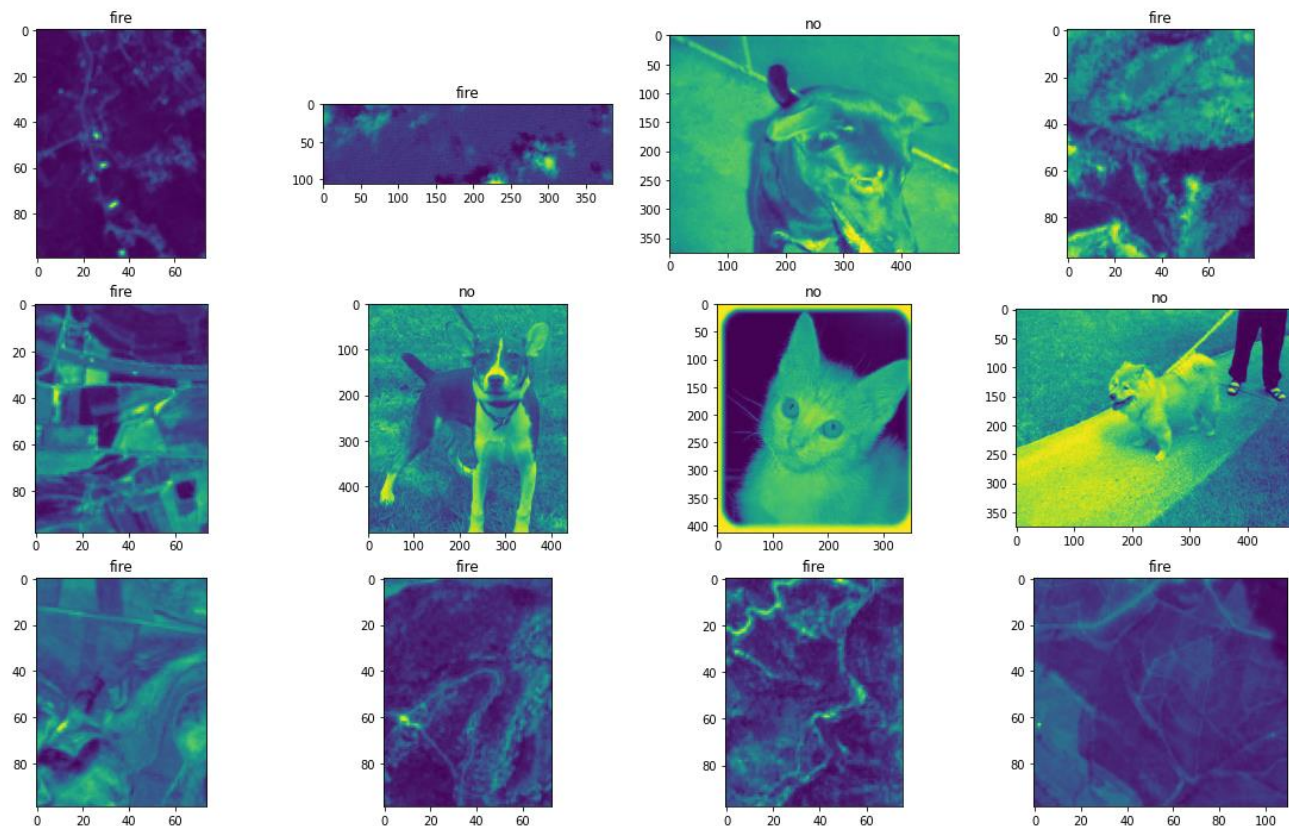
Step 3. Train the model

Model: **Visual Transformer.**

Classification between
*“potential place for future
fire”* and *“no future fire”*.

```
efficient_transformer = Linformer(  
    dim=128,  
    seq_len=49+1, # 7x7 patches + 1 cls-token  
    depth=12,  
    heads=8,  
    k=64  
)
```

```
model = ViT(  
    dim=128,  
    image_size=224,  
    patch_size=32,  
    num_classes=2,  
    transformer=efficient_transformer,  
    channels=1, # FIXED! Channels=1 (grayscale)  
) .to(device)
```





Step 4. Evaluating and predictions

3 options to predict:

- From **URL image**.
- From **Image Upload**.
- From **Lat/Lon (click on map)**.

14. Predictions using trained Visual Transformer, from File Upload.

```
[176]: uploader = FileUpload(  
    accept="", # Accepted file extension e.g. '.txt', '.pdf', 'image/*', 'image/*,pdf'  
    multiple=False # True to accept multiple files upload else False  
)  
display(uploader)
```

Upload (1)

```
[177]: uploaded_file = list(uploader.value.values())[0]  
with open("./temp.png", "wb") as fp:  
    fp.write(uploaded_file['content'])  
  
imgwidget = ImageWidget(value=uploaded_file['content'])  
display(imgwidget)
```



```
[178]: data = prepare_data_for_model_from_image_path("./temp.png")  
preds = model(data)  
get_label_message_from_prediction(preds)  
prev data shape: torch.Size([1, 224, 224])  
data shape: torch.Size([1, 1, 224, 224])
```

potential future fire 🔥

Thanks!



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