Utilizing PyTorch for Wildfire Detection

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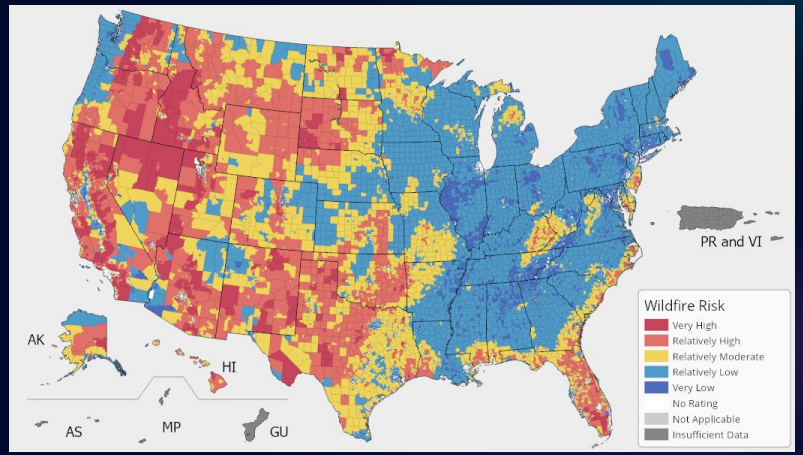
Problem Overview:
Too much fire!

- Between 2010 and 2022, Wildfires annually burned 7.2 million acres of land in average in the United States



https://hazards.fema.gov/nri/wildfire

https://adventr.co/2022/08/spruce-mountain-fire-lookout-tower/

- **Increasing rate** of fire in the forests
- Dangerous conditions for the **fire watchers**
- Aging infrastructure

How to Fix?
Using Computer Vision

- Wildfires can be more easily managed or even prevented if they are **detected earlier**.
- Can be used to **identify wildfires** occurring under **different conditions**
  - **Fog, Night, Smoke**
- **Solution:** ML Model to identify Wildfires

Approach:
Model

PyTorch

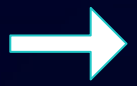
ResNet50
Adam Optimizer
LR Scheduler

Custom Image Folder

Wildfire Data

2700 Pre-categorized
Fire image data

Transforms:
Resize to 224,224
Random Rotation (10°)
Random Horiz-Flip

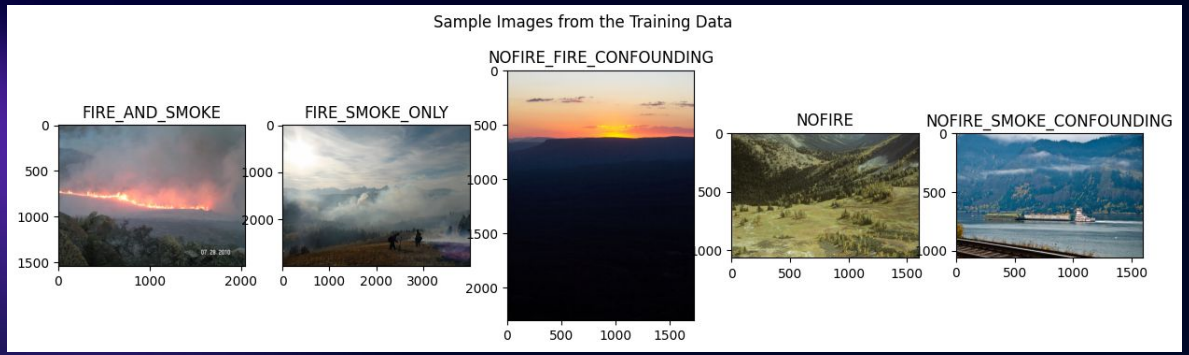


Detection Model

Classification Model
Fire vs No Fire

Approach:
Data

	Train	Test	Val
Both_smoke_and_fire	269	59	57
Smoke_from_fires	461	100	99
Fire_confounding_elements	236	52	50
Forested_areas_without_confounding_elements	591	128	127
Smoke_confounding_elements	330	71	69



Size

2700 images

~ 11 GB

Resolution

Average: 4057×3155 pixels
Minimum: 153×206 pixels
Maximum: 19699×8974 pixels

Variety

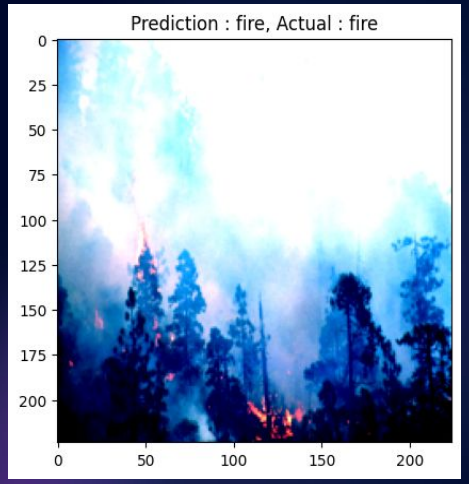
- Environmental scenarios
- Forest variants
- Geographical locations
- Intricate dynamics of forest ecosystems and fire events

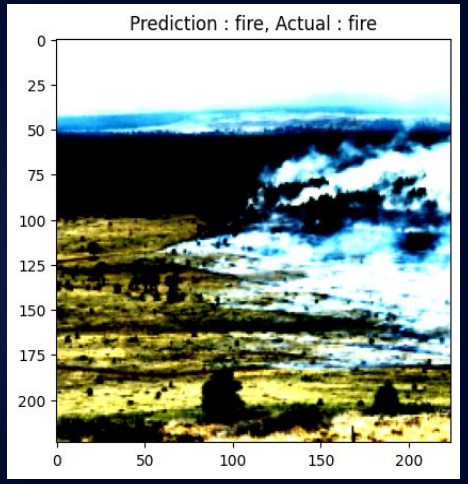
Results

Model Results

- **Train Loss** : 0.81858 ...
- **Train Accuracy** : 71.38%

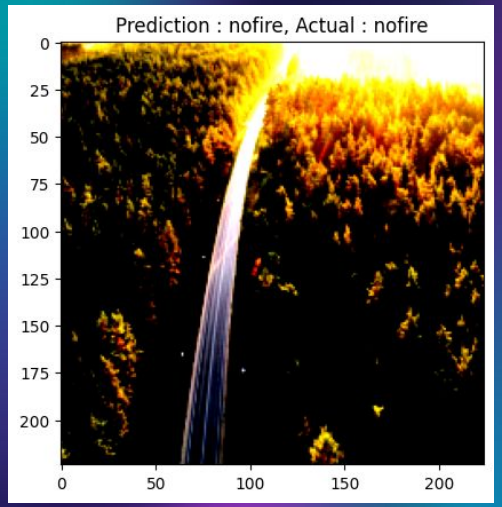
- **Test Loss** : 0.64919 ...
- **Test Accuracy** : 68.29%

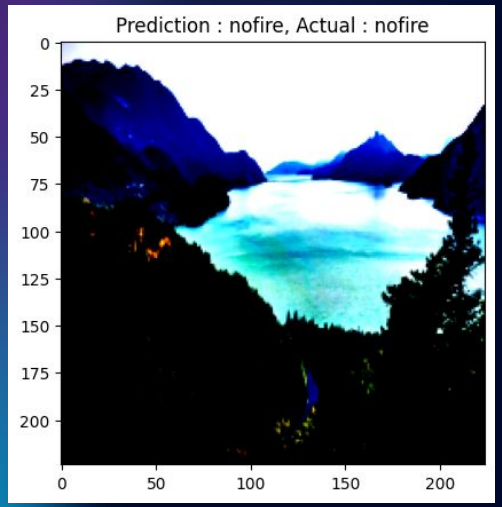


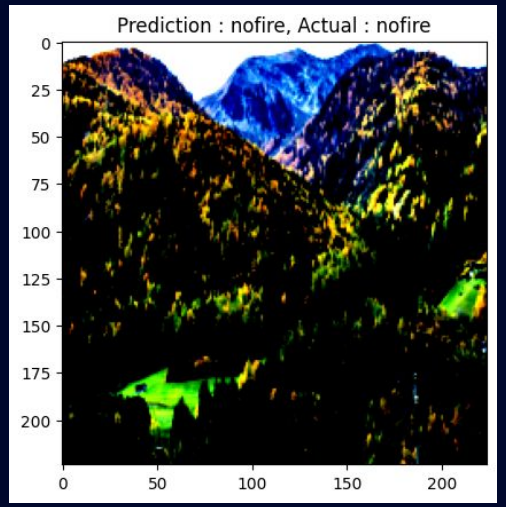


Top 2: Fire

Bottom 3: No Fire







Project Improvements

01

Better Model

Higher accuracy could be actually useful

02

Apply to Live Data

Use real-time data from forests to detect real wildfires quick

03

Motion Detection

Smoke moves upwards, Fog moves sideways

04

API?

Open the model to everyone so they can watch their own forest

Questions?

Thank you!