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Search And Rescue of humans and animals trapped in Fire using YOLO

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Abstract -
In the event of a fire, the main concern of first responders and firefighters is to rescue people trapped in the burning area. We suggest a way to identify people trapped in tropical areas, in a way that will ensure the safety of firefighters and speed up the rescue process. The proposed method suggests the use of Infrared (IR) cameras to capture hot images in a burning environment as they may not be distorted by smoke. Deep learning technique using CNN and YOLO would be applied on thermal images to detect humans and animals in smoke and fire situations.

Keywords: YOLO, CNN, SSD, Fire Detection, Human Detection, Animal Detection, PyTorch

1. INTRODUCTION

Forest fires cause great damage to the earth every year.
Despite being described as a 'natural' phenomenon, "International Union for Conservation of Nature (IUCN)" Global Outbreak of Forest Fire 2000, 90% of wildfires are caused by human activity. Wildfires lead to significant forest losses (6–14 million hectares of forest annually) and contribute to 30% CO. This results in severe health loss, global warming, environmental degradation, entertainment and vital resources. There is an urgent need for a comprehensive, international response to forest fires.

More recently, image detection has become a hot topic for research. This process has many advantages such as high accuracy, flexible system installation and the ability to effectively detect fires in large areas and complex structures, image processes. Processing image data from a camera with algorithms to determine the presence of fire or fire hazard in photos. Therefore, the detection algorithm is at the heart of this technology, directly determining the performance of the image fire detector.

There are three main stages in a photo fire detection process, which includes pre-image processing, feature removal, and fire detection. In between, feature extraction is a key component in algorithms. The custom algorithm depends on the manual selection of the fire element and the machine learning phase. Dependency of the shortcoming of algorithms is that manual feature selection should on professional knowledge. Though the researchers develop many studies in image features of smoke and fire, only simple image features, such as colour, edges and simple textures, are discovered. However, because of complex fire types, scenes as well as interference events in practical application, the algorithms extracting low and middle complex image features are difficult to distinguish fire and fire-like, thus resulting in low precision and weak general efficiency.

2. METHODOLOGY

Like previous versions, the YOLOv5 architecture was built based on theory and released with a repository on GitHub. As mentioned, Ultralystic builds YOLOv5 on the PyTorch framework, which is one of the most popular frameworks in the AI community. However, this is just the first structure, researchers can design structures to provide the best results depending on their problems such as adding layers, removing blocks, merging more.

2.1 Setting up Flask environment for Yolov5

1. The goal is to have a web page at frontend so that user can upload their images and video.
2. After clicking on Send Button, the file will be uploaded to backend server, where we will process it with our Yolov5 Model.
3. After processing to the model, system will return the image to the flask frontend.
4. A new Download Button will appear, and user will be able to download the processed file.
5. For Live Detection, user can detect using web cam of the device.

2.2 Dataset Collection

Because of the non-availability of many humans and animals in fire datasets on the internet, we preferred to gather datasets from roboflow, youtube, articles, etc. This dataset consists of images that are quite small in size but allow for the ability to test generalizability and effectiveness. It can be concluded that to detect humans and animals trapped in fire it is better to use deep convolutional neural networks. With this dataset and great accuracy, it signifies that the deeper the architecture, the more it can understand the features.

2.4 Preparing the dataset for training

After the dataset is collected and downloaded to the personal computer (PC), we annotate the objects in the image by giving bounding boxes.

Create 2 folders of Dataset containing:
train –images use for training
test –images use for test.

2.5 Training of Model

Run that command to finally train your dataset. We can change the batch size depending on your PC's Specifications. Training time will depend on the performance of your PC. We can also train different versions of YOLOv5 algorithm. AI will take different combinations and provide different combinations of FPS (Frames Per Second) and Accuracy.

2.6 Testing of Model

Now, we will copy the model that we have trained and paste it into project directory.
We will put some sample videos and images for reference in Test/ directory for testing the model. Your last photos and videos are stored in Results / Documents.

2.7 Setting up alert system

We will be using telegram bot to send alert messages. The steps are as follows: -

1. Set the telegram token for system
2. If the object is detected, bot will send the alert messages on telegram

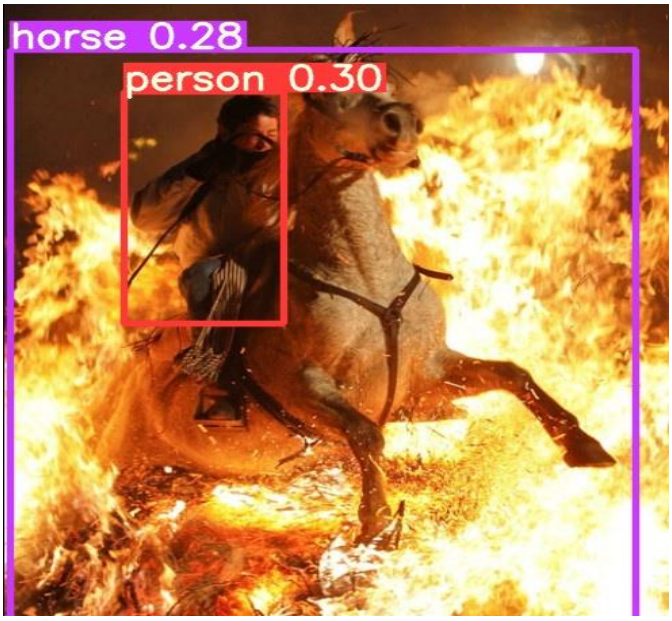

Fig 3: Human and Animal Detection

3. CONCLUSION

We are proposing to find people trapped in tropical areas, in a way that will ensure the safety of firefighters and speed up rescue efforts. The proposed method suggests the use of Infrared (IR) cameras to capture hot images in a burning environment as they may not be distorted by smoke.

Fig 1: Human Detection

Fig 2: Animal Detection

4. REFERENCES

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