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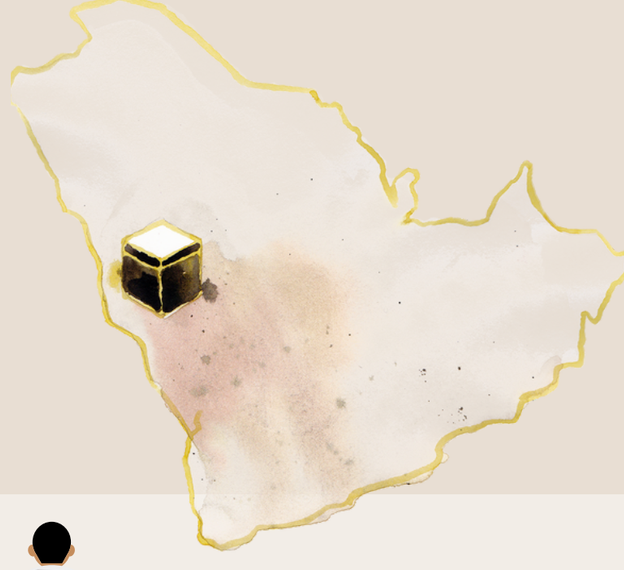
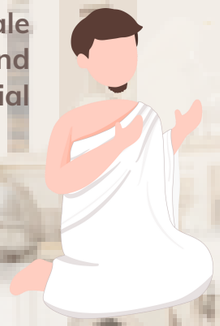


1 Problem

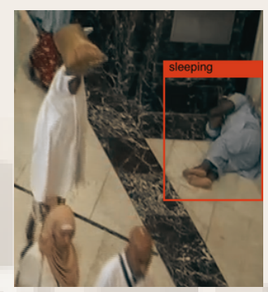
Alhamdulillah, Saudi Arabia has the honor of serving pilgrims and visitors to the two holy mosques.
As we know, every year the ministers of Hajj and Umrah need to set up a plan for Hajj organizational operations to handle the millions of pilgrims and make Hajj easier for them.
For that, our project aims to automate the detection and recognition of abnormal behaviors in large-scale crowds. Furthermore, it helps security agencies and decision-makers visualize and anticipate potential risks.



2 HAJJ Dataset

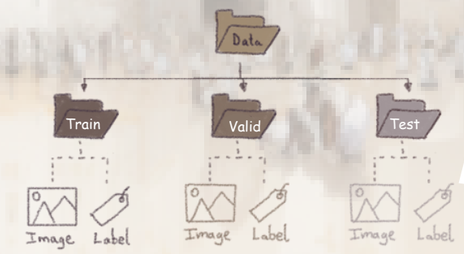
The HAJJ dataset is a collection of nine videos from the annual Hajj religious event, capturing individuals' abnormal behaviors in massive crowds. The videos, captured in various scenes (“Massaa”,“Jamarat”, “Arafat”, and “Tawaf”), are cropped and split into training and testing sets. The videos show various abnormal behaviors, including standing, sitting, sleeping, running, and non-pedestrian activities, which can pose a risk to large-scale crowd flows.

	Classes	Training	Testing
1	Different Crowd Direction	7152	6262
2	Moving In Opposite	36,577	18,802
3	Moving Non Human Object	4186	4146
4	Running	51	190
5	Sitting	100,633	83,644
6	Sleeping	2400	2618
7	Standing	19,773	14,107
	Total	170,772	129,769



3 Model Building

- Extracting the frames from the videos and save them.
- Convert the annotation to YOLOv5 format.
- YOLOv5 with MobileNetv2 Backbone for Abnormal Object Detection.
- Optical Flow Feature Extraction.
- Random Forest (RF) Classification for Object Categorization.



4 Used Technologies

python™
OpenCV
scikit learn
YOLO

Rreference: https://www.mdpi.com/2079-9292/12/5/1165