



AI Watcher: Forecasting the Future of Crowd Density in mall

A DATA-DRIVEN APPROACH USING OBJECT
DETECTION MODELS



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OBJECTIVES

The goal of this project is to analyze foot traffic in malls by counting the number of people and predicting their distribution across predefined zones using object detection techniques and predict the future trends.



DATASET DESCRIPTION

Dataset:

Mall Surveillance Images

Description:

- Images captured from mall security cameras.
- Resolution: 640x480 pixels.
- Includes real-world challenges such as crowd density and other objections such as (tree, truck, etc..,).
- Extracted data for time series

Frame Work – CRISP DM

Business Understanding

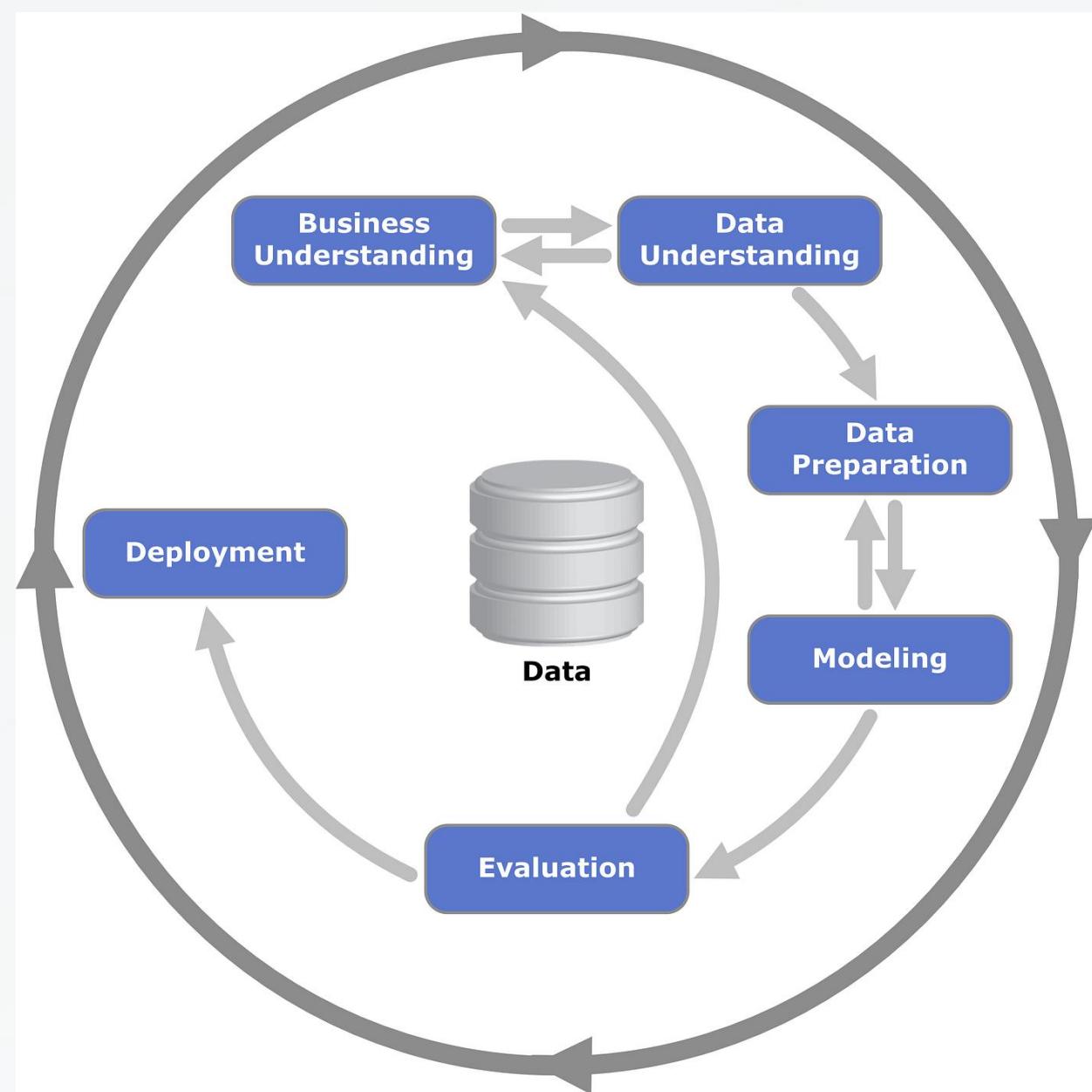
- Detecting People in the image
- Which zone has the highest volume
- Resource Allocation decision depends upon the count

Data Understanding

- Image datasets
- Assumed timestamps

Data Preparation

- Image pre processing
- Cleaned data for missing values in time series
- Label generation for zone –wise counts



Modelling

- Object Detection (Faster-RCNN)
- Deep Learning (VGG16)
- Time Series Analysis (ARIMA/SARIMA)

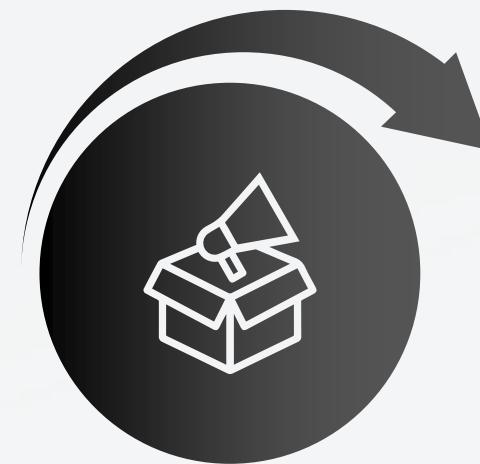
Evaluation

- Object detection Results
- Deep learning model metrics
- Time series forecasts
- Validation

Deployment

- Streamlit-based UI
- Integrated Ngrok for secure external access

METHODOLOGY



Model Loading

Load TensorFlow Hub
Faster RCNN model for
object detection



Loading Mall Surveillance Images

Preprocess Mall
Surveillance Images

Object (People) Detection

Detect people in
images and extract
bounding boxes.



Zones

Divide images into
predefined zones (e.g.,
quadrants).

Prediction with Time Series

Count individuals in
each zone and predict
density patterns.



IMPLEMENTATION

Use pre-trained object detection models to identify people.



Count the number of bounding boxes in each zone.



Define zones using coordinate boundaries.

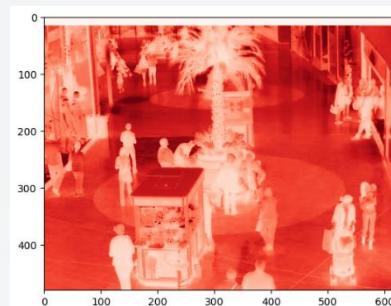


Time Series Algorithm for forecasting people count.

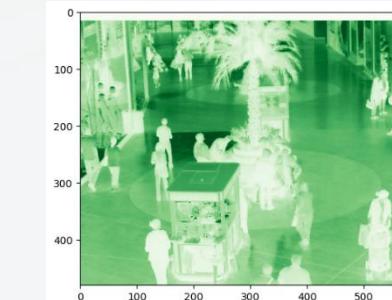


OBJECT DETECTION

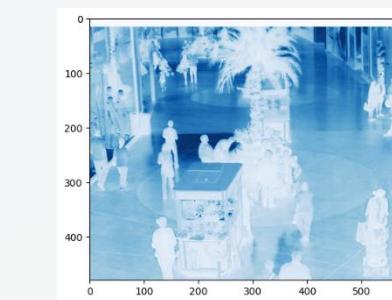
Slide: 08



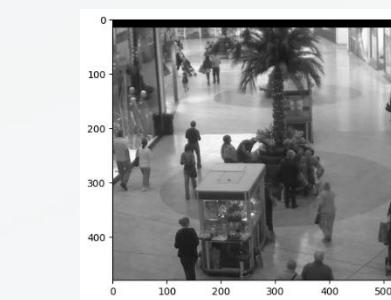
Red Color



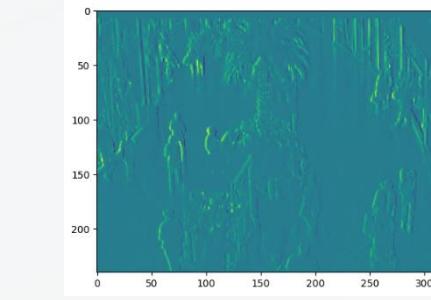
Green Color



Blue Color



PaddedImage



MaxPool

Image data

Found 100 objects.
Inference time:
40.51781415939331
Total number of people detected:
27 CPU times:
user 1min 35s,
sys: 35.5 s,
total: 2min 11s
Wall time: 40.9 s



Image with total number

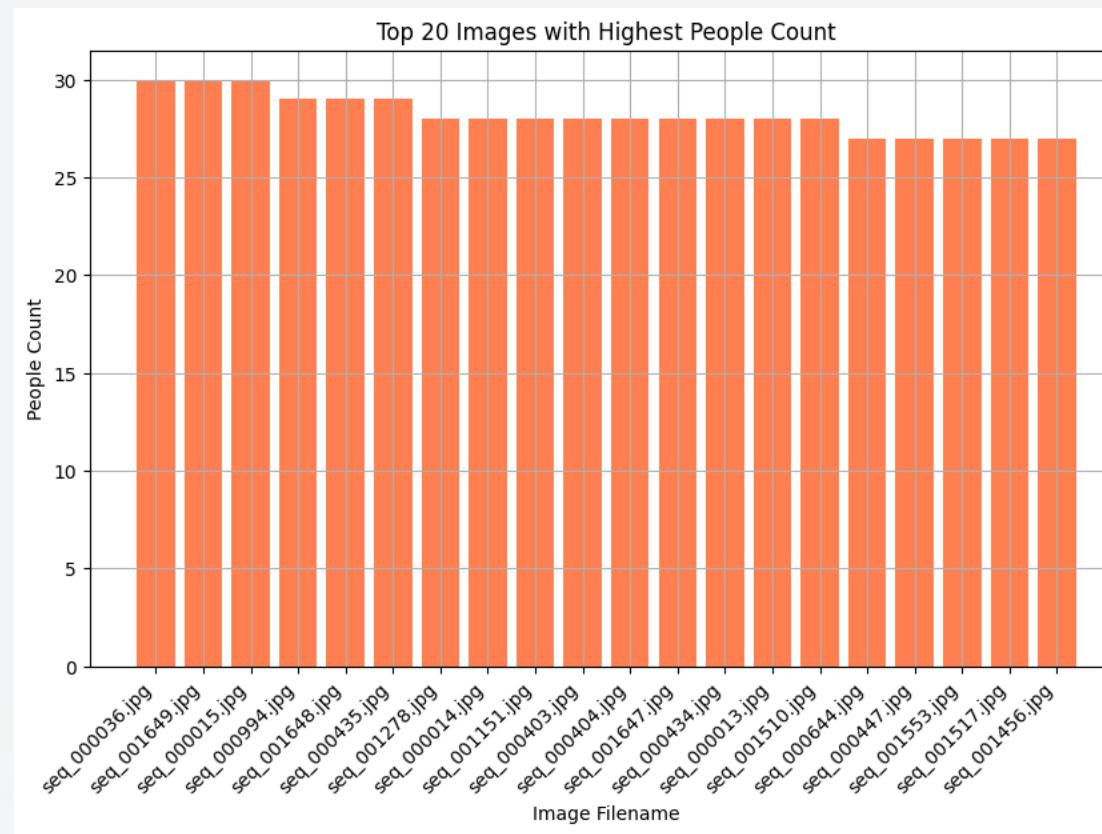


Image with total number and zone wise count

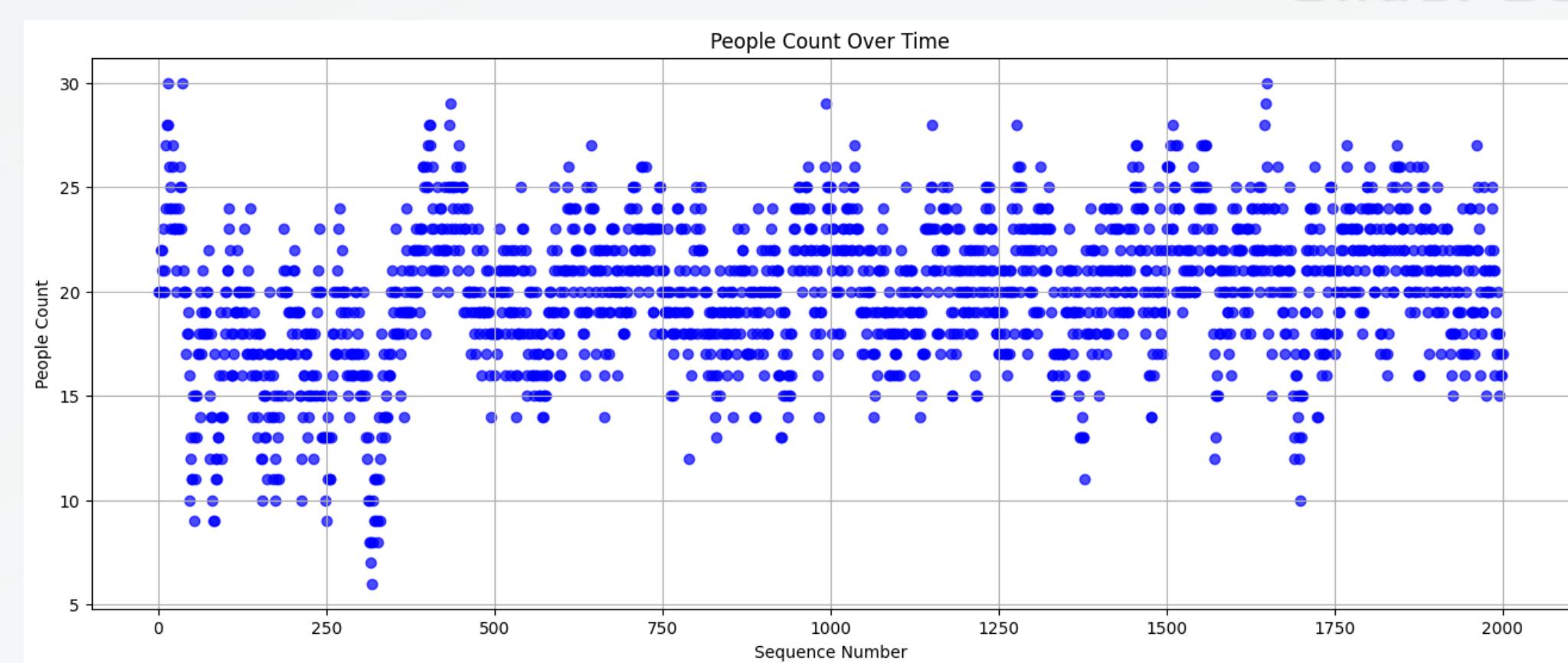
Total number of people detected: **27**
Zone-wise people count:
Zone 1: 5 Zone 2: 6
Zone 3: 7 Zone 4: 6

DATA VISUALISATION

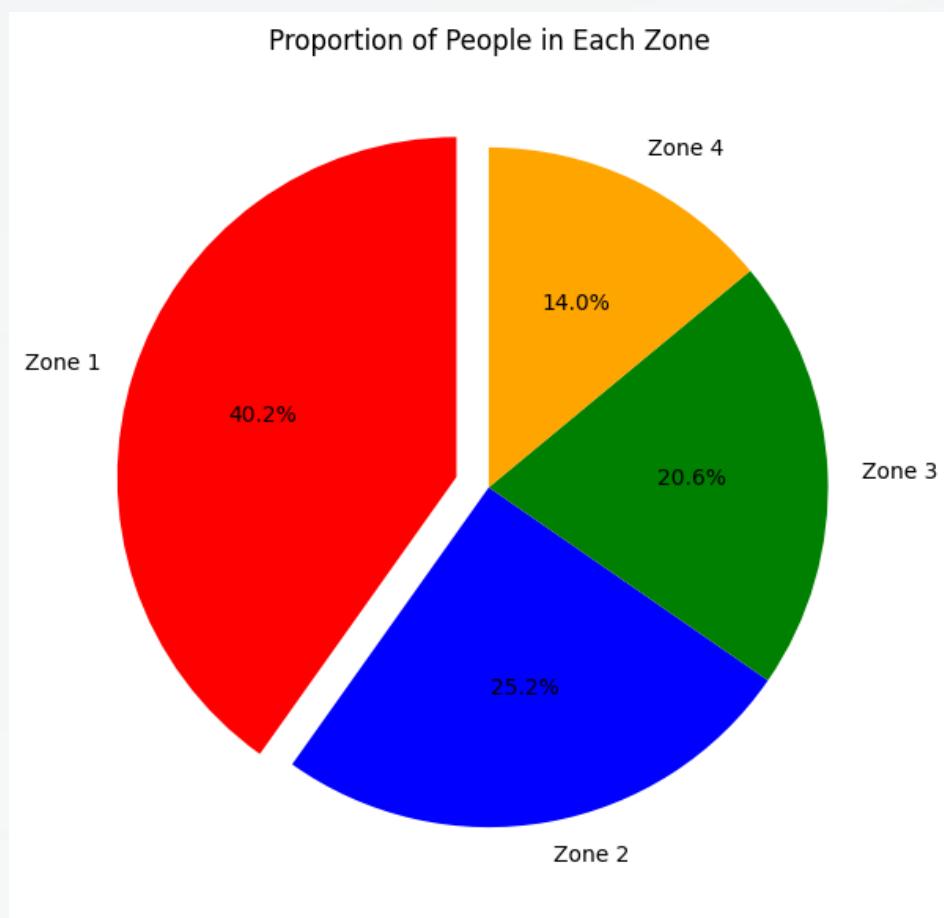
Slide: 09



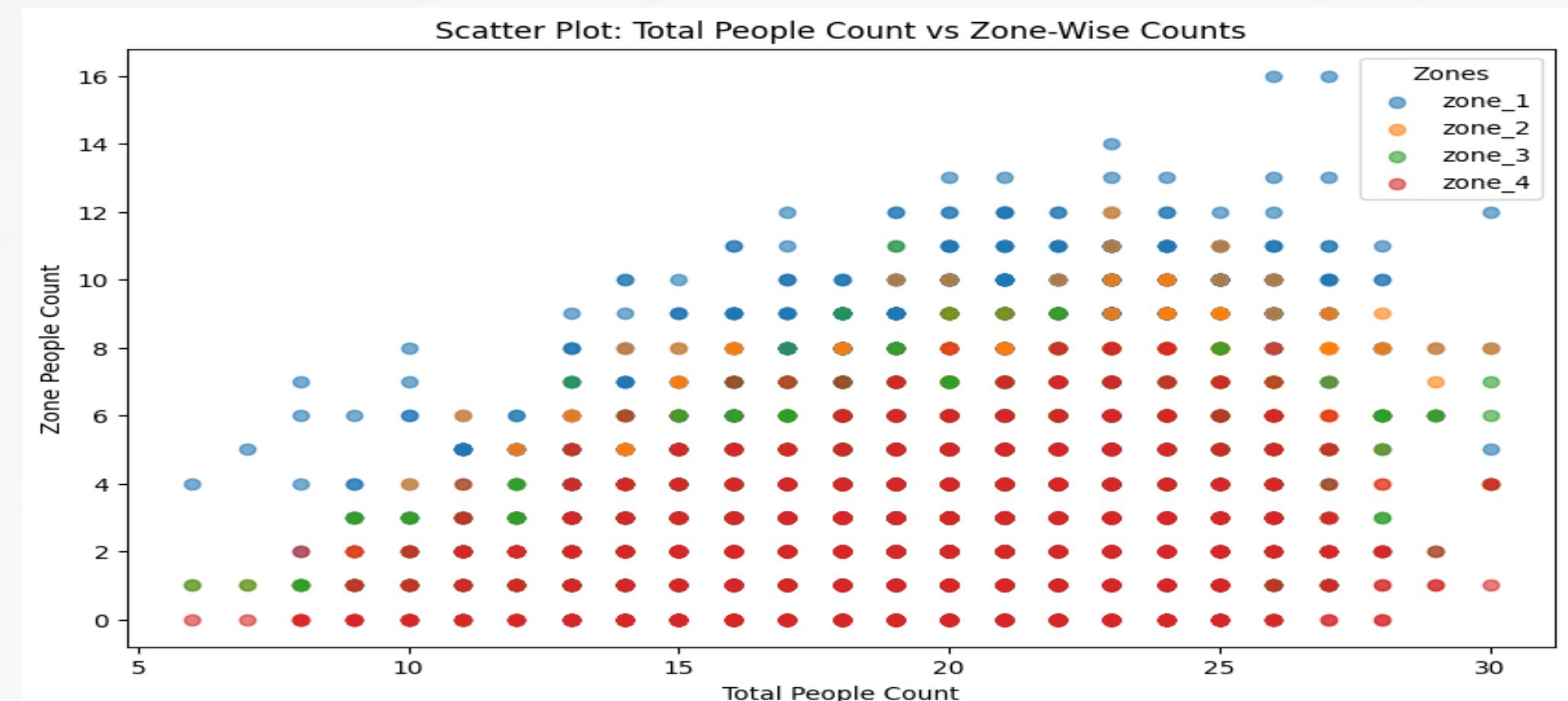
Top 20 images that has the highest people count



People count over time from the data



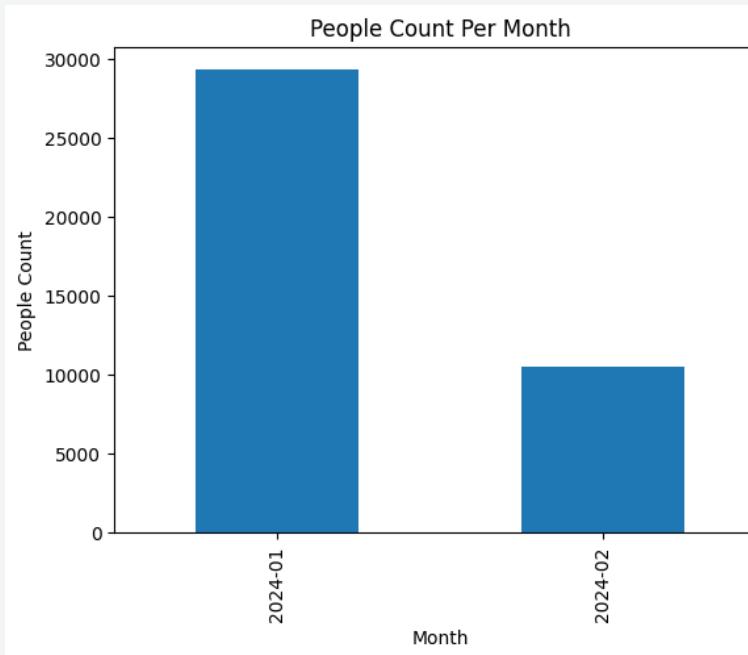
People percentage in each zone



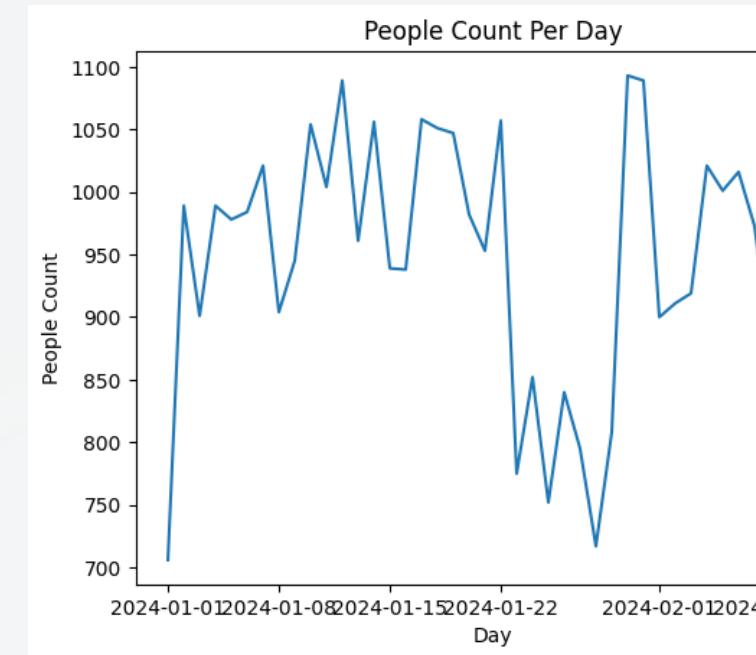
Zone People Count vs Total People

TIME SERIES ANALYSIS

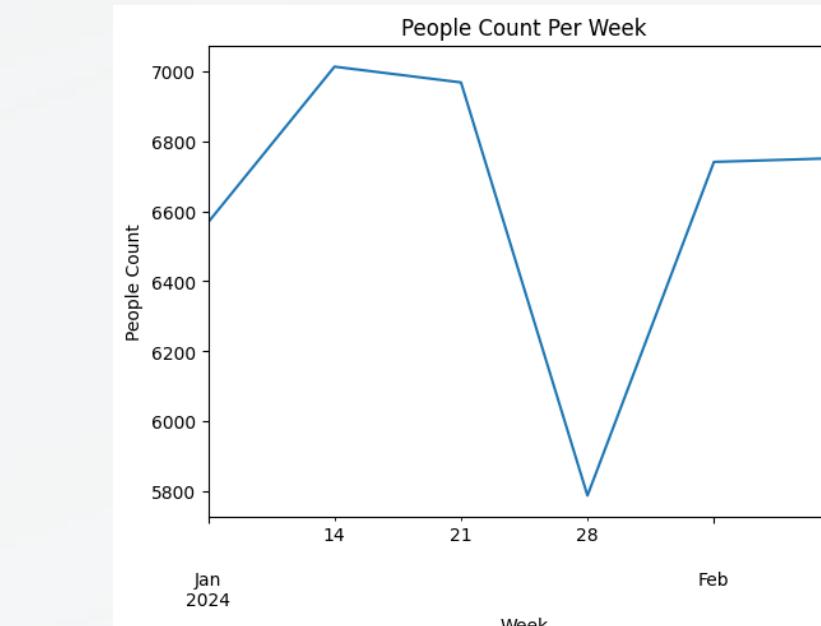
Slide: 10



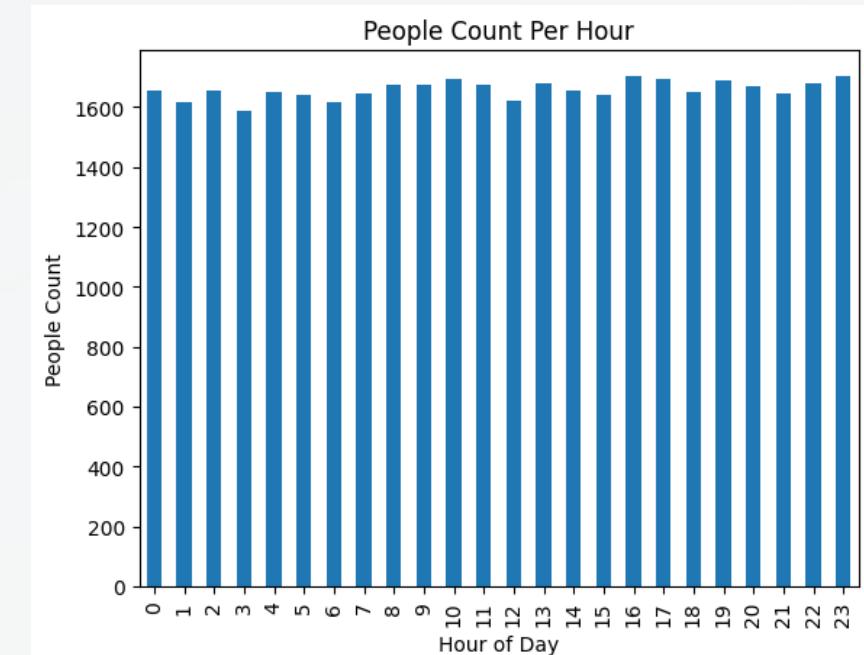
People count per month



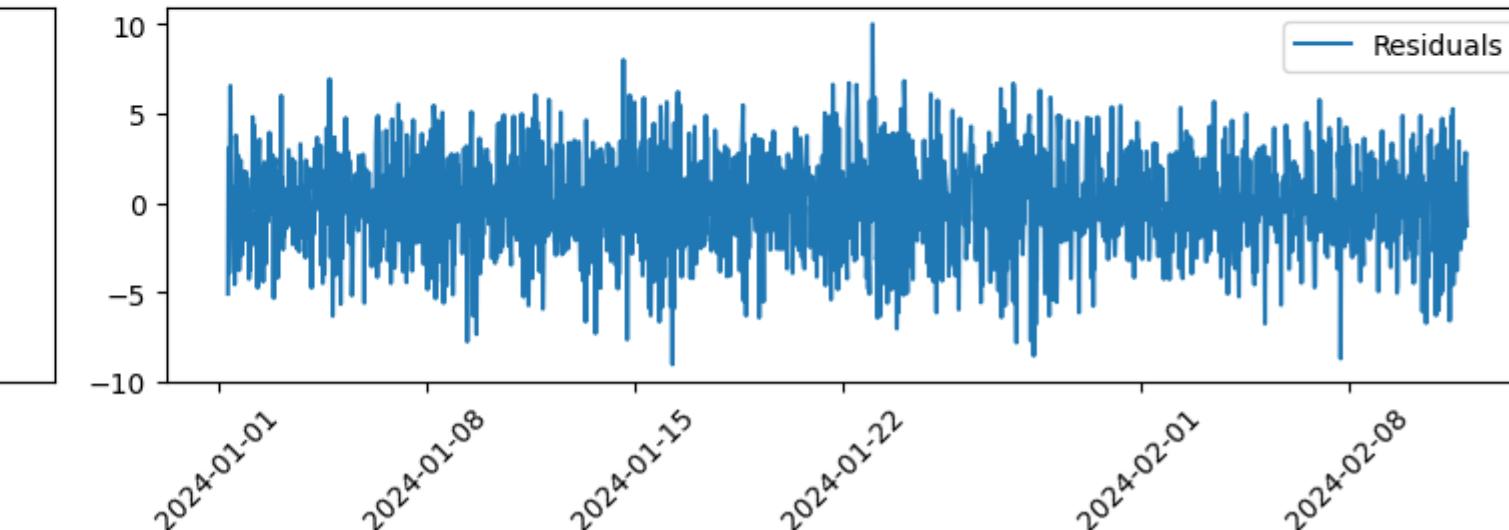
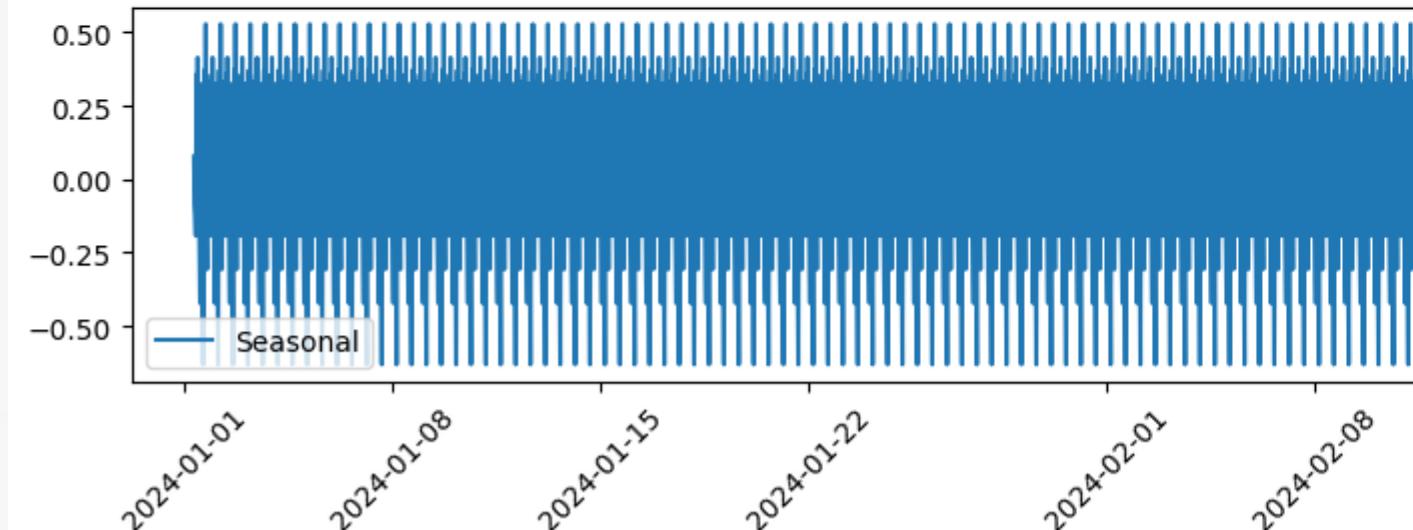
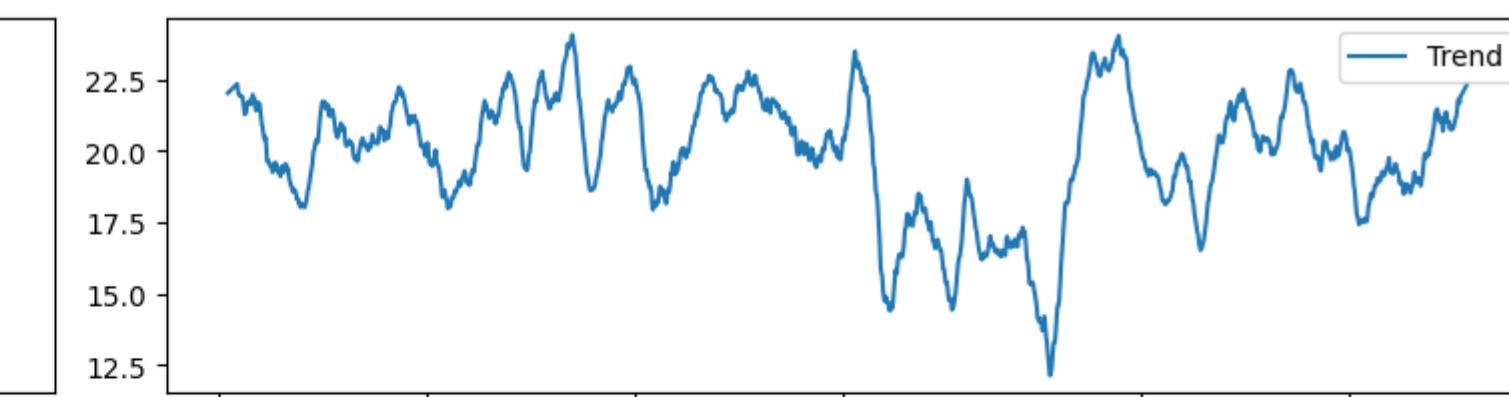
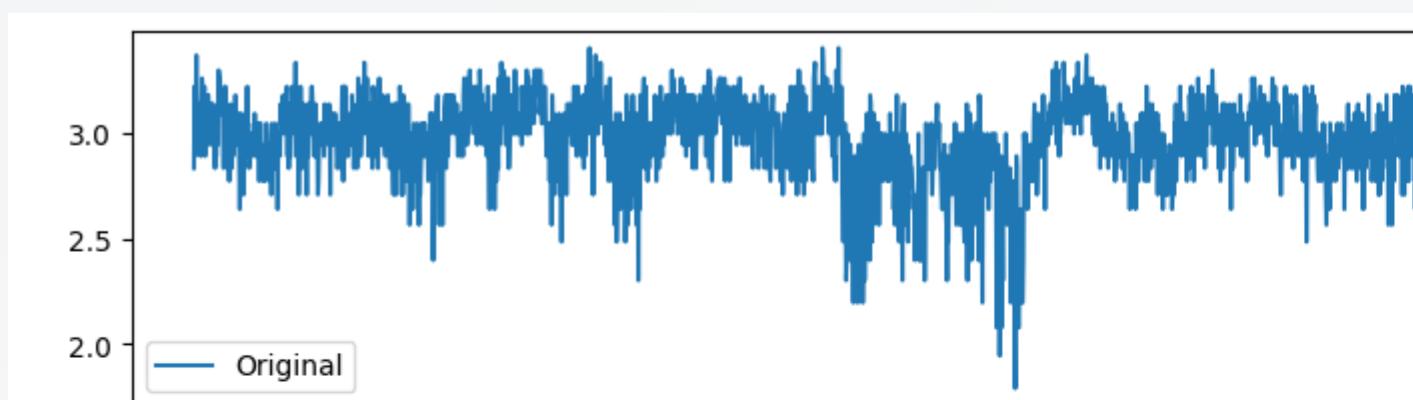
People count per day



People count per week



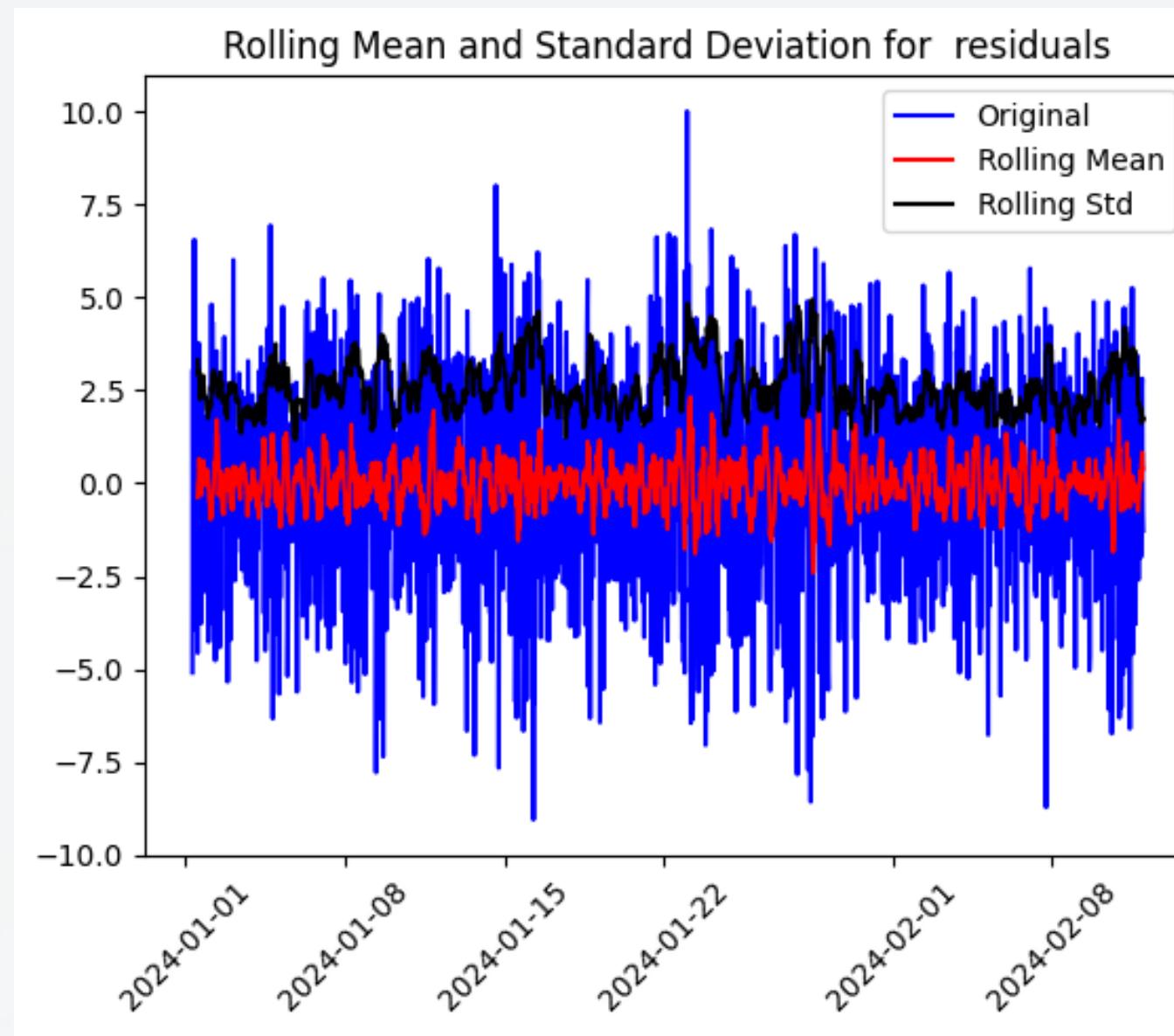
People count per hour



Trend, Seasonal, Residuals

FORCASTING PEOPLE COUNT

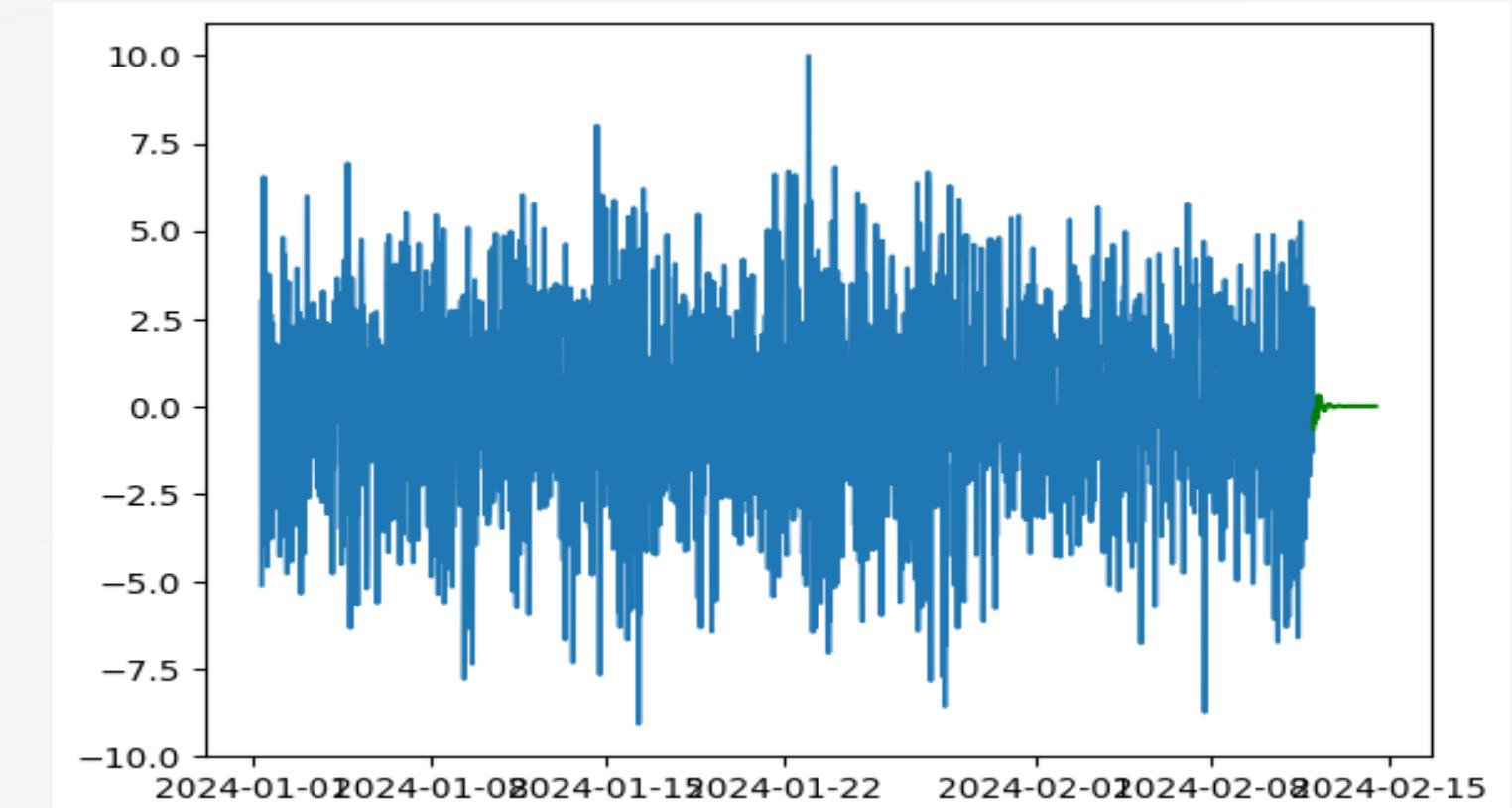
Slide: 11



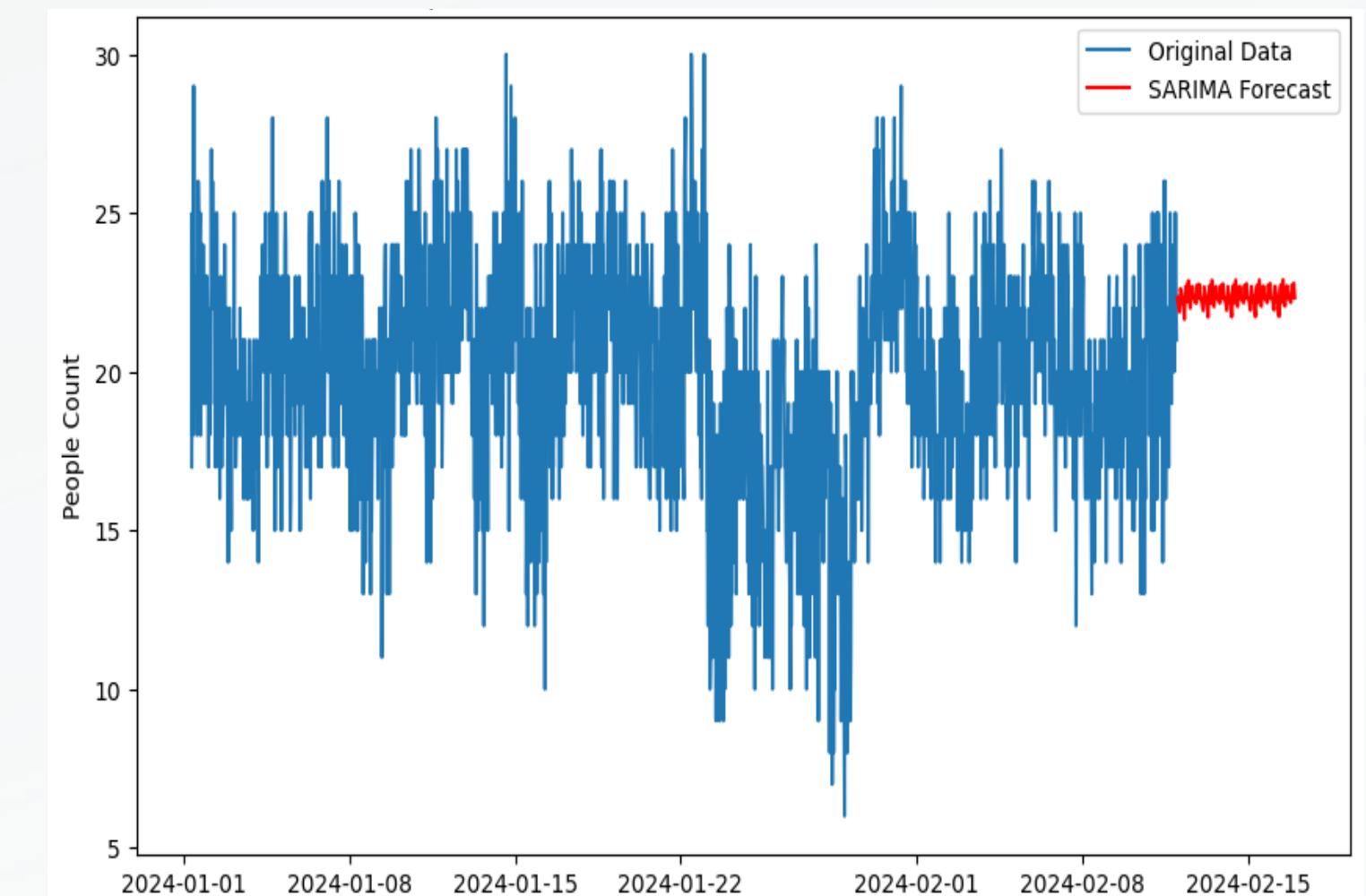
Results:

- Test Statistic -1.469902e+01
- **p-value 2.966891e-27**
- # Lags Used 2.400000e+01
- Number of Observations 1.975000e+03
- Critical Value(1%) -3.433665e+00
- Critical Value(5%) -2.863005e+00
- Critical Value(10%) -2.567550e+00
- dtype: float64

ARIMA



SARIMA



RESULTS

Detected people accurately in test images.



Analyzed foot traffic distribution across zones



Visualized results with bounding boxes and zone predictions with People Count Forecast with SARIMA



PREDICTIONS

Zone-wise People Count

Zone 1: 7 people

Zone 2: 4 people

Zone 3: 4 people

Zone 4: 3 people

Improve Mall Traffic with AI-Powered People Counting

Upload Image

Drag and drop file here
Limit 200MB per file • JPG, PNG, JPEG

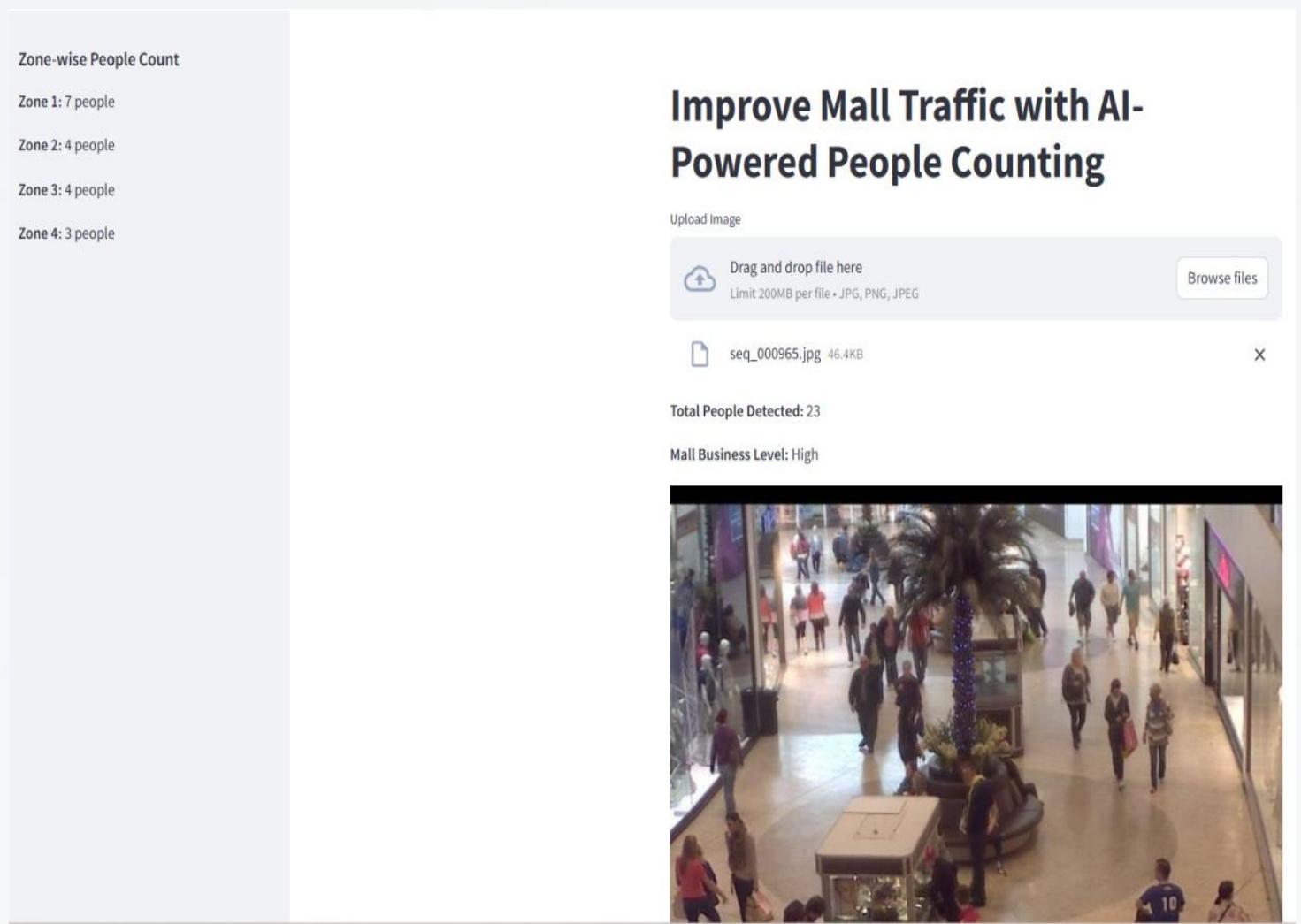
Browse files

seq_000965.jpg 46.4KB

X

Total People Detected: 23

Mall Business Level: High



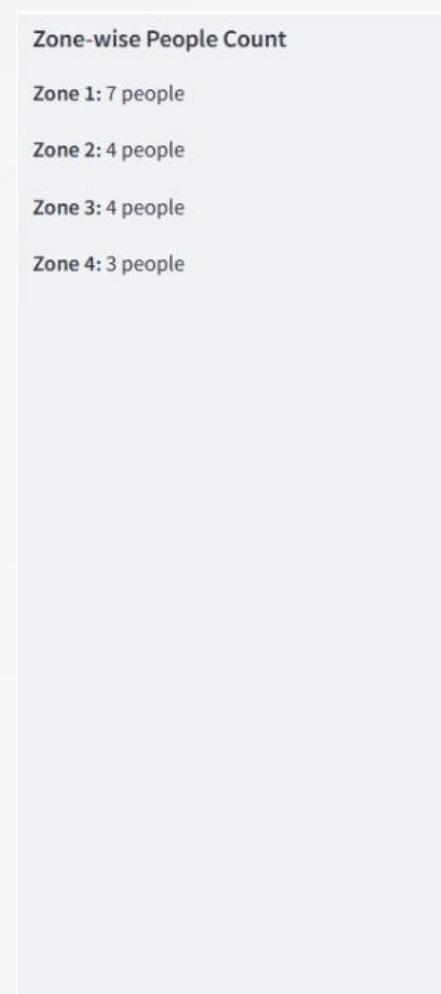
Zone-wise People Count

Zone 1: 7 people

Zone 2: 4 people

Zone 3: 4 people

Zone 4: 3 people



Tools and Technologies

Libraries and Tools

- Deep Learning: TensorFlow, Keras
- Time Series: Statsmodels, NumPy, Arima, Sarima
- Object Detection: OpenCV, PIL
- Visualization: Matplotlib
- UI: Streamlit, Ngrok

GANTT CHART

NNN PROJECT

ITC

Project lead : Chandana

Model Developer : Vinay

Time Series Analyst : Devika

Task	Assigned To	Progress	Start	End
Initiation				
Define Project goals	Chandana, Vinay, Devika	100%	11/12/24	11/13/24
Set up team roles	Chandana	100%	11/13/24	11/14/24
Planning and design				
Create schedule	Chandana	100%	11/14/24	11/14/24
Identify deliverables	Vinay	100%	11/15/24	11/15/24
Tasks	Chandana, Vinay, Devika	100%	11/15/24	11/18/24
Execution				
Execute tasks	Chandana, Vinay, Devika	100%	11/19/24	11/21/24
Monitor progress	Chandana	100%	11/15/24	11/18/24
Testing and validation	Vinay, Devika	100%	11/15/24	11/22/24
Evaluation				

Project start: **Tue, 11/12/2024**

Display week: 1

SWOT ANALYSIS



CONCLUSION

The project successfully demonstrates the use of object detection models to count individuals in mall images and predict zone-based distributions, enabling better crowd management and operational planning, also forecasting crowd locations.

FUTURE RECOMMENDATIONS

- Real Time Video Processing for live detection
- Recognition of people
- Hybrid models to fine tune for advanced predictions
- Automate anomaly detection for irregular patterns

DEMO

