

Vision-based student activity observance system for the MCAST library

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Proposed research

Research area – Human Activity Recognition through Computer Vision.

Research topic – Realtime vision-based student activity recognition system using MCAST library surveillance cameras.

Study aim – To determine whether computer vision can be used with the MCAST library's surveillance cameras to track students and classify their activities (reading, writing, using a phone...).

Real world issue

- Currently the MCAST library staff do not have enough accurate data from survey reports to make informed decisions.
- Research gap in the field of Human Activity Recognition (HAR) through surveillance cameras for education environments.
- HAR systems have seen a positive impact in healthcare and security. Extending HAR to a library can lead to an improved learning environment and use of resources.

Hypothesis & Questions

Hypothesis

- Real-time computer vision detection and tracking algorithms can accurately detect and monitor individual students and library objects within the MCAST library's surveillance footage. Furthermore, an activity classifier is used to determine the specific activity task of each student and measure the duration period.

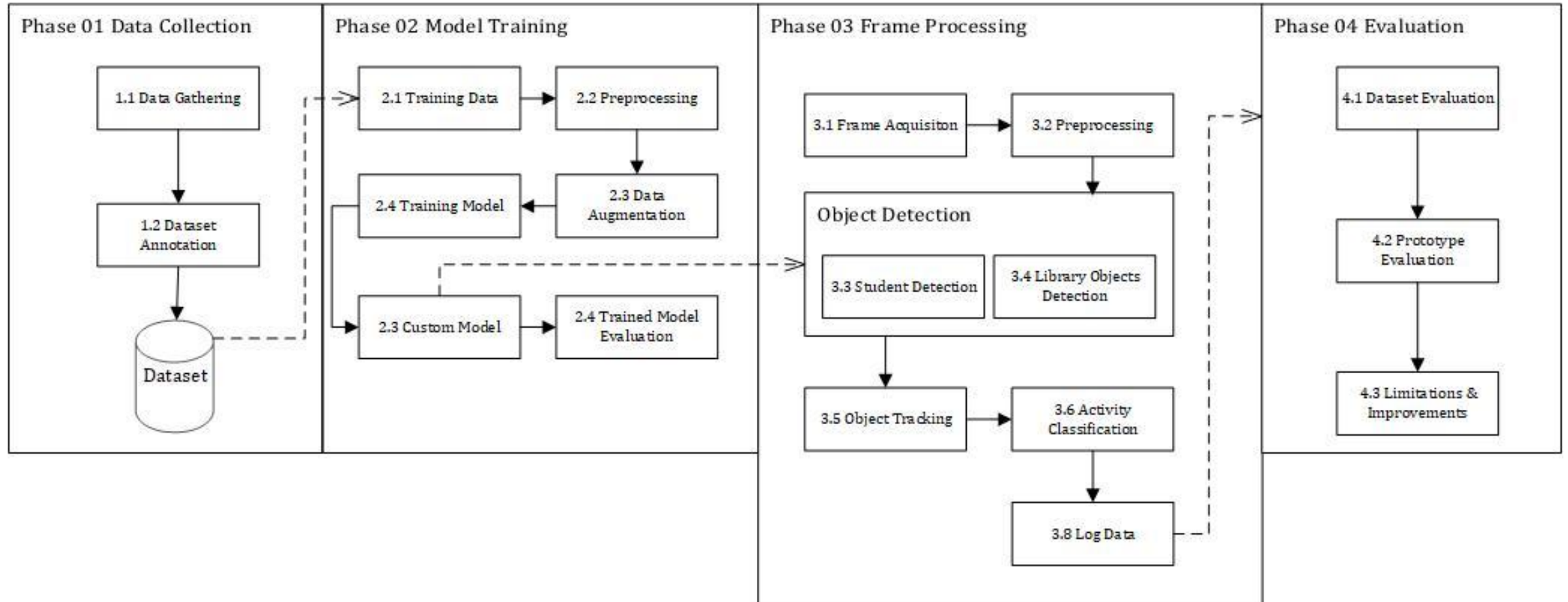
Research Questions

1. Which object detection algorithm can robustly detect users and activity objects from wide perspective angles?
2. How can a robust activity classification algorithm be developed for a library?
3. How can the algorithm determine the specific activity that the student is engaged in when the student has multiple different potential activities surrounding them?

Comparison table

Author(s), Year, reference	Topic	Techniques used	Activity Classifier	Results
Ismail et al. 2024 [1]	Customer Activity Detection Using YOLOv8 and Status Order Algorithm	YOLOv8 and DeepSORT	Activities were determined based on the presence of objects in the table's spatial zone	Inconsistent detections due to the camera angle and low resolution were discovered
Phatangare et al. 2023 [2]	Real Time Human Activity Detection using YOLOv7	YOLOv7	Activities were classified by YOLO.	Results were effective but with a low accuracy. A larger dataset could increase accuracy.
Garcia-Garcia and Pinto-Elias. 2022 [3]	Human activity recognition implenting the yolo models	YOLOv5, YOLOv6, YOLOv7	Activities were classified by YOLO.	Results were effective for detecting standing, sitting and falling. YOLOv7 obtained the best results

Methodology Pipeline



Implementation environment

Google Colab – Programming environment

Python – Programming Language

YOLOv8 – Object Detector

DeepSORT – Object Tracker

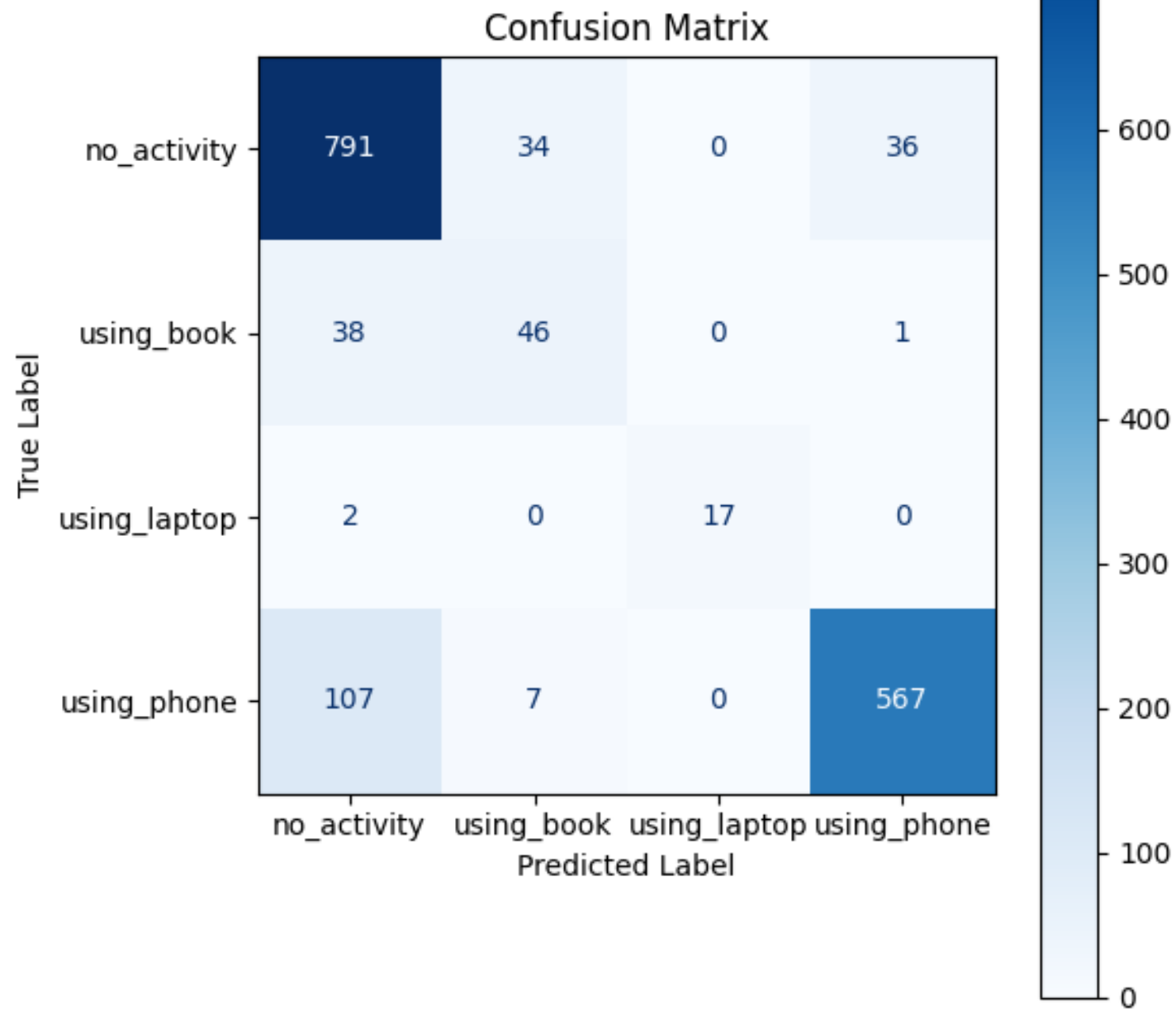
Activity Class	Precision	Recall	F1-Score
<i>no_activity</i>	0.84	0.92	0.88
<i>using_book</i>	0.53	0.54	0.53
<i>using_laptop</i>	1.00	0.89	0.94
<i>using_phone</i>	0.94	0.83	0.88

Results – Activity Metrics



Results

- Confusion Matrix



Conclusion

86% Overall accuracy,
demonstrating performance.

Small dataset.

False positives from activity
classifier.

Flawd activity classifier
design.

Future works

Larger dataset with wide-perspective angles.

Activity classifier using pose estimation.

More recent YOLO model iteration.

References

- [1]M. Ismail *et al.*, “Customer Activity Detection Using YOLOv8 and Status Order Algorithm,” in *Proceedings - 2024 International Conference on Cyberworlds, CW 2024*, Institute of Electrical and Electronics Engineers Inc., 2024, pp. 301–307. doi: [10.1109/CW64301.2024.00042](https://doi.org/10.1109/CW64301.2024.00042).
- [2]S. Phatangare, S. Kate, D. Khandelwal, A. Khandetod, and A. Kharade, “Real Time Human Activity Detection using YOLOv7,” in *7th International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud), I-SMAC 2023 - Proceedings*, Institute of Electrical and Electronics Engineers Inc., 2023, pp. 1069–1076. doi: [10.1109/I-SMAC58438.2023.10290168](https://doi.org/10.1109/I-SMAC58438.2023.10290168).
- [3]S. Garcia-Garcia and R. Pinto-Elías, “Human Activity Recognition implenting the Yolo models,” in *Proceedings - 2022 International Conference on Mechatronics, Electronics and Automotive Engineering, ICMEAE 2022*, Institute of Electrical and Electronics Engineers Inc., 2022, pp. 127–132. doi: [10.1109/ICMEAE58636.2022.00029](https://doi.org/10.1109/ICMEAE58636.2022.00029).

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Thank you

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