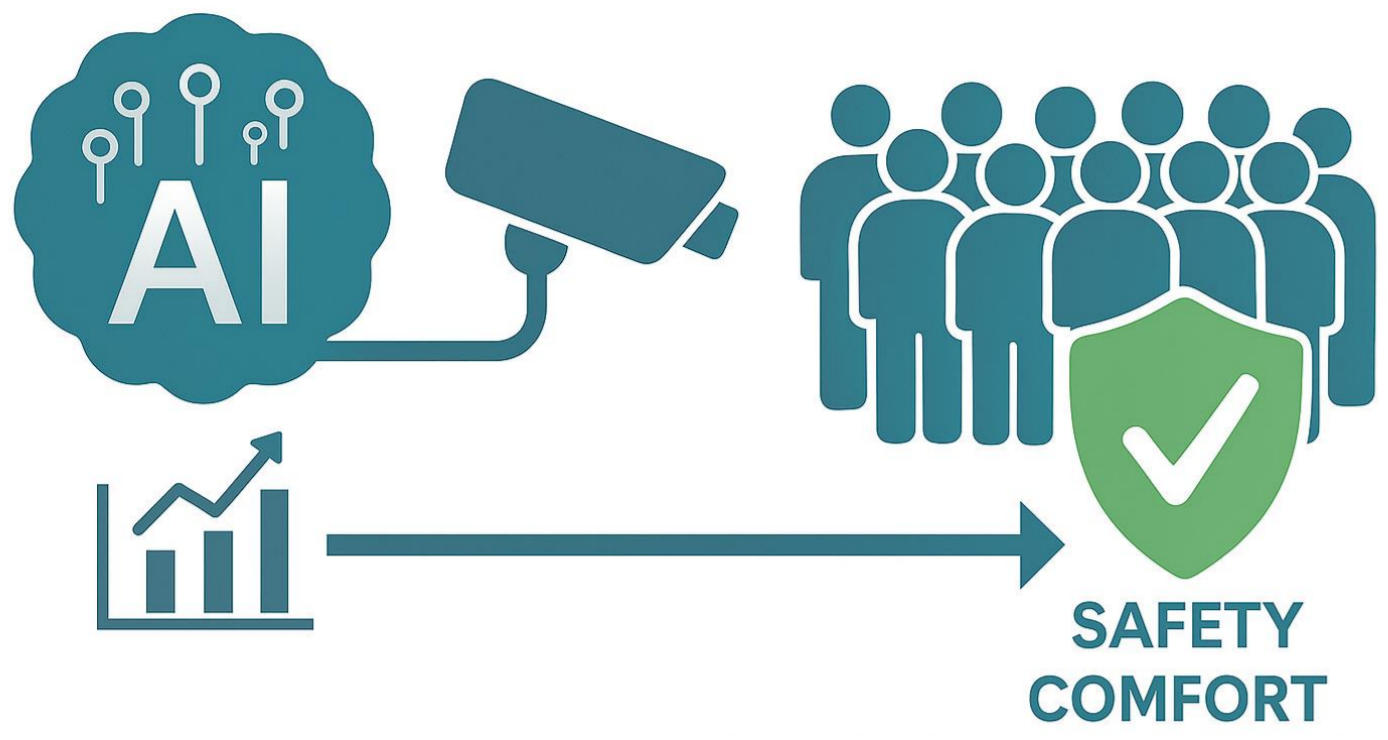


Vision AI for Crowd Analysis

Detecting Pushing Behavior and Pedestrian Heads

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Goal and Motivation



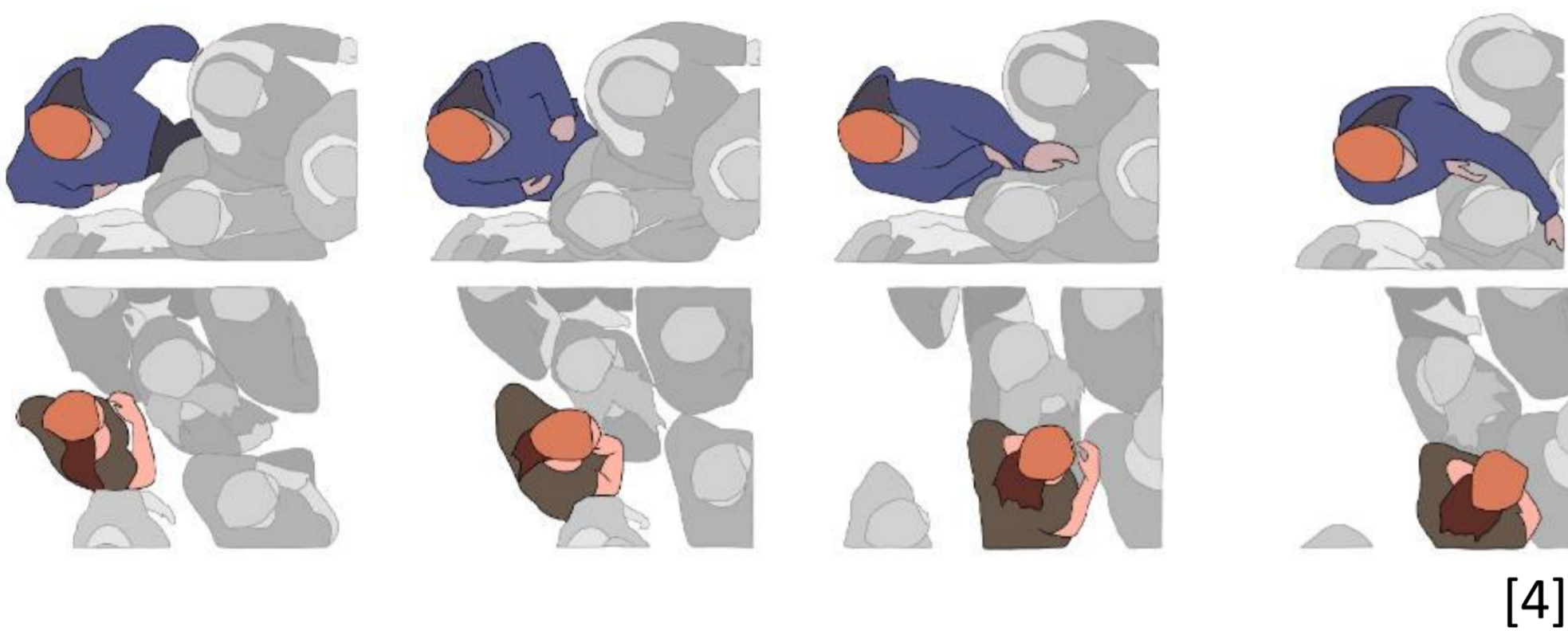
- Employing AI to extract insights from crowd videos for a better understanding of human crowds.
- Understanding crowds is crucial for effective crowd management and **enhanced public safety**.

This poster highlights three Vision AI projects developed at IAS-7:

- Two projects focus on detecting pushing behavior.
- One project supports broader crowd analysis tasks.

AI for Automatic Pushing Behavior Detection

Pushing Behavior



- In crowded environments, some pedestrians could start pushing others to move faster and reach their destination more quickly.
- Such behavior often increases the crowd's density, potentially posing a threat not only to people's comfort but also to their safety.
- Detecting pushing behavior in videos and live streams enhances understanding of crowd dynamics.

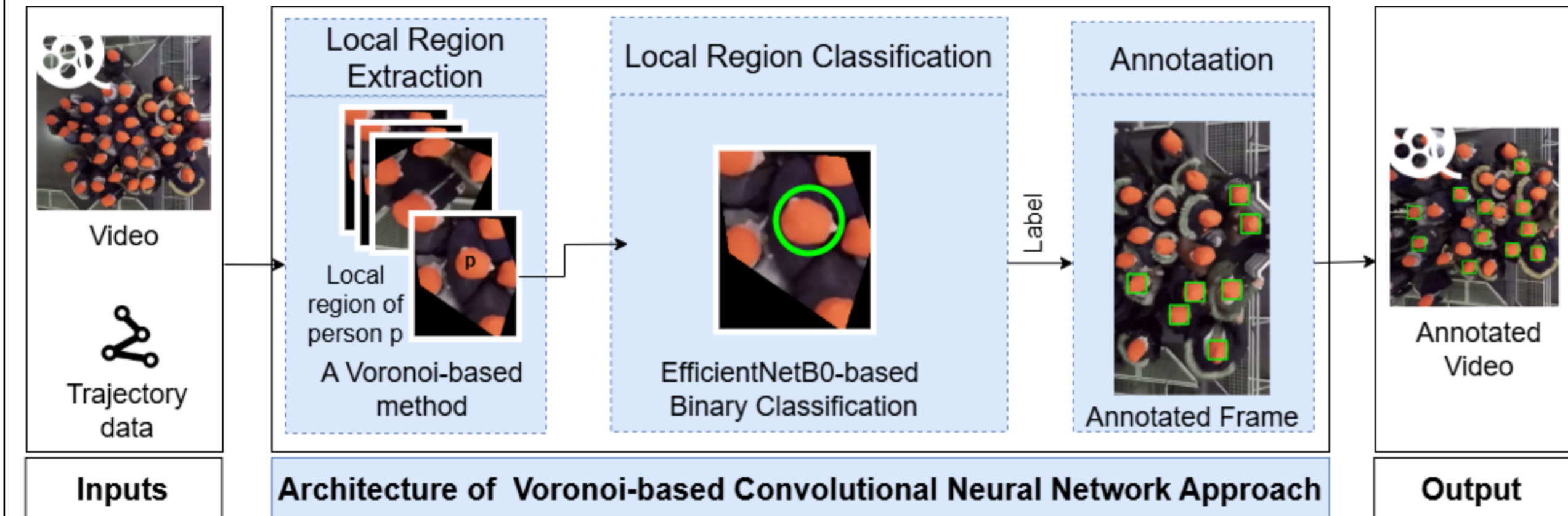
[4]

Detection of Pushing Behavior at the Individual Level [1]

Aim: Developing an automatic Voronoi-based CNN approach for pushing detection at the person level.

Motivation: Knowing when, where, and why pushing occurs enables safer, more **effective crowd management strategies**.

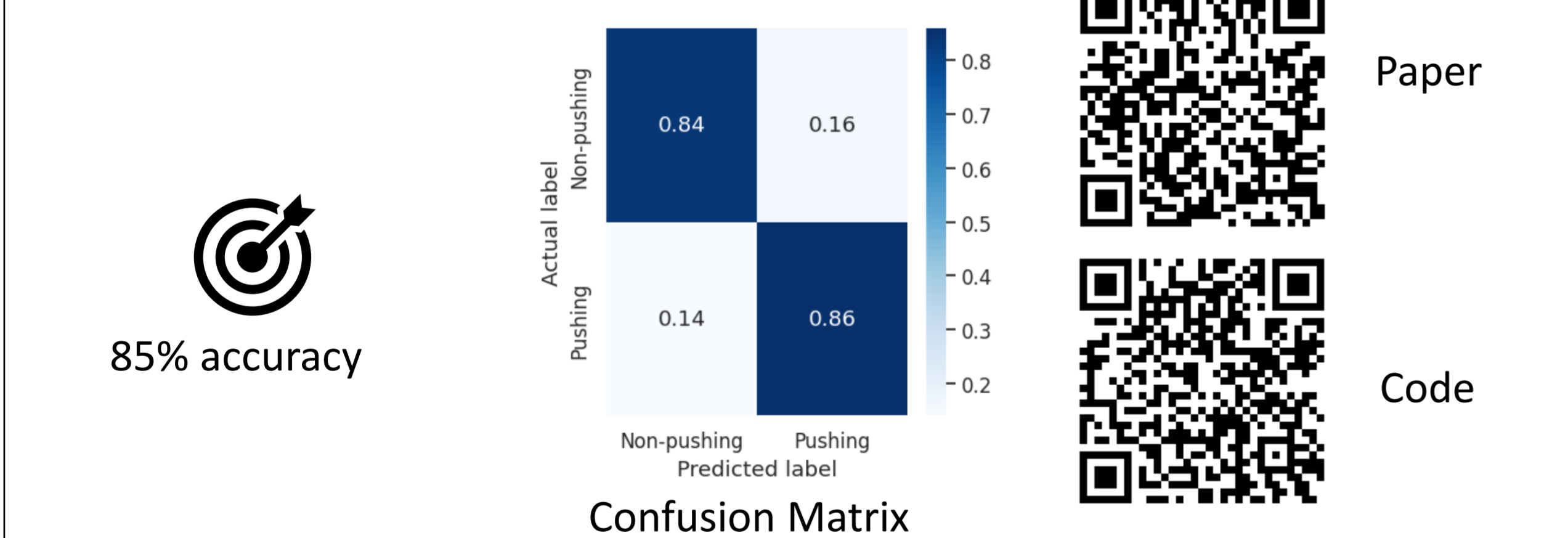
Approach



Dataset



Results



Ground Truths [4]

Data Sources

6 real-world experiments

Duration: 398 s

12,829 Persons

Labeled Frames

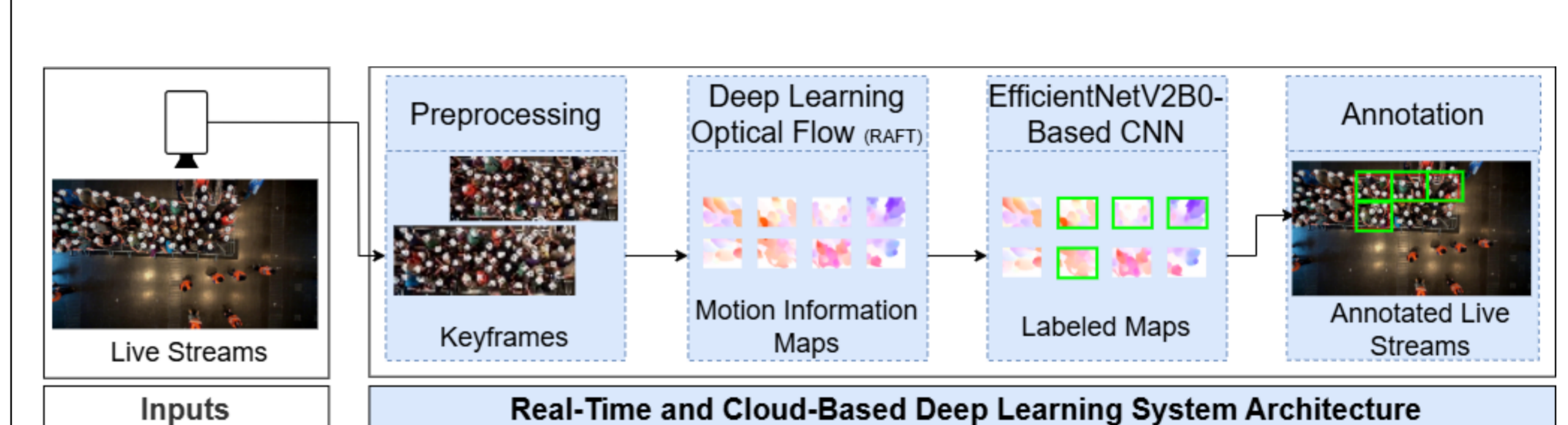


Early Detection of Pushing Behavior at the Patch Level [2]

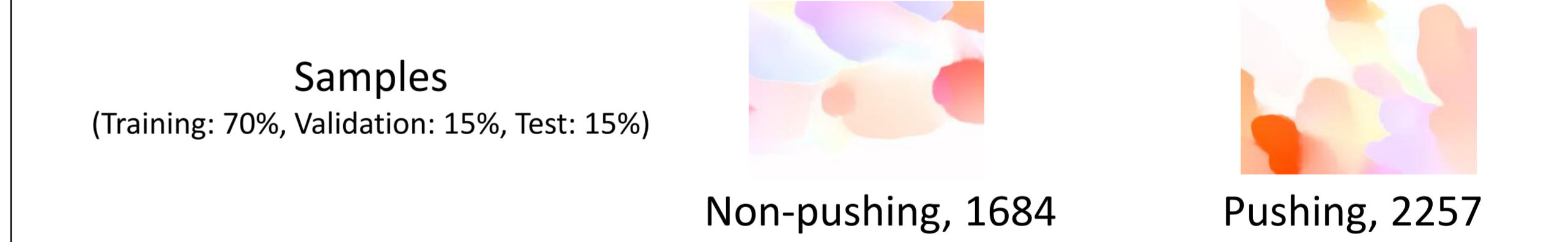
Aim: Developing a novel, real-time, cloud-based deep learning system for automatically detecting pushing behavior at the patch level.

Motivation: Helping organizers and security personnel **intervene early** and **mitigate dangerous situations**.

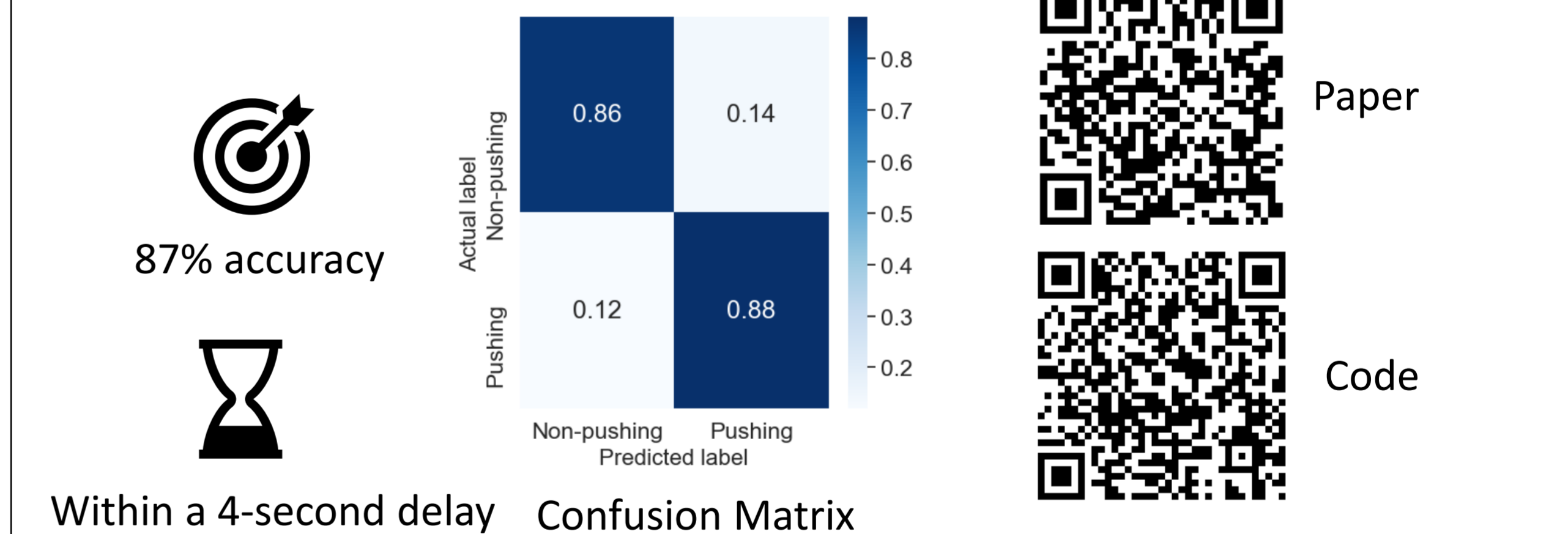
System



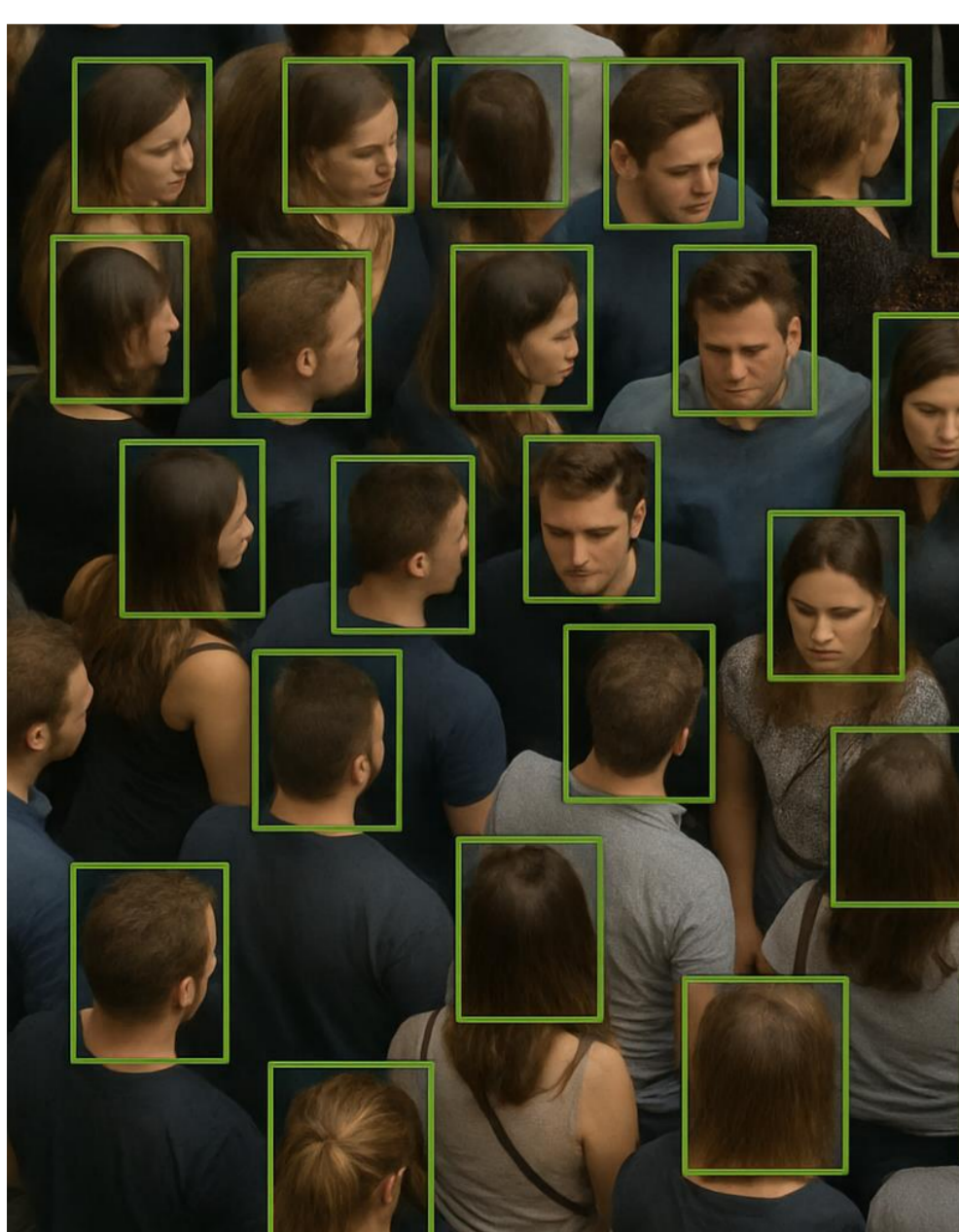
Dataset



Results



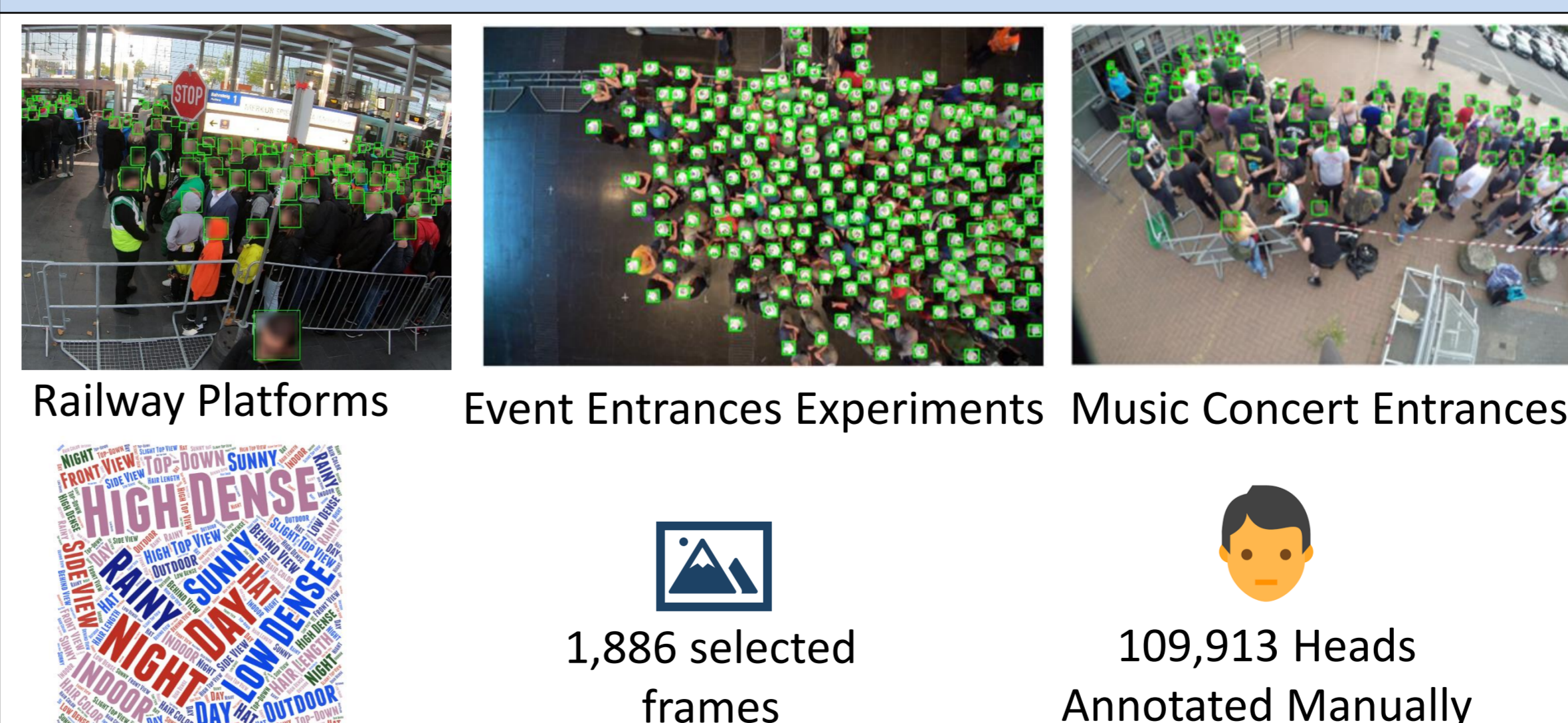
Pedestrian Head Detection Benchmark in Crowded Scenes [3]



Challenge

- Accurate head detection is vital for crowd analysis and safety.
- Crowded environments, such as railway platforms and events, are underrepresented in datasets.
- **Better datasets → stronger AI models for head detection.**
- **Efficient AI models → improved crowd analysis → enhanced public safety.**

A New Diverse Annotated Dataset



Trained Models



References

- [1] Alia, A., Maree, M., Chraibi, M., & Seyfried, A. (2024). A novel Voronoi-based convolutional neural network framework for pushing person detection in crowd videos. *Complex & Intelligent Systems*, 10(4), 5005-5031.
- [2] Alia, A., Maree, M., Chraibi, M., Toma, A., & Seyfried, A. (2023). A cloud-based deep learning framework for early detection of pushing at crowded event entrances. *IEEE access*, 11, 45936-45949.
- [3] Abubaker, M., Alsadder, Z., Abdelhaq, H., Boltes, M., & Alia, A. (2025). RPEE-Heads Benchmark: A Dataset and Empirical Comparison of Deep Learning Algorithms for Pedestrian Head Detection in Crowds. *IEEE Access*.
- [4] Üsten, E., Lügering, H., & Sieben, A. (2022). Pushing and non-pushing forward motion in crowds: A systematic psychological observation method for rating individual behavior in pedestrian dynamics. *Collective dynamics*, 7, 1-16.