M2DAR: Multi-View Multi-Scale Driver Action Recognition with Vision Transformer

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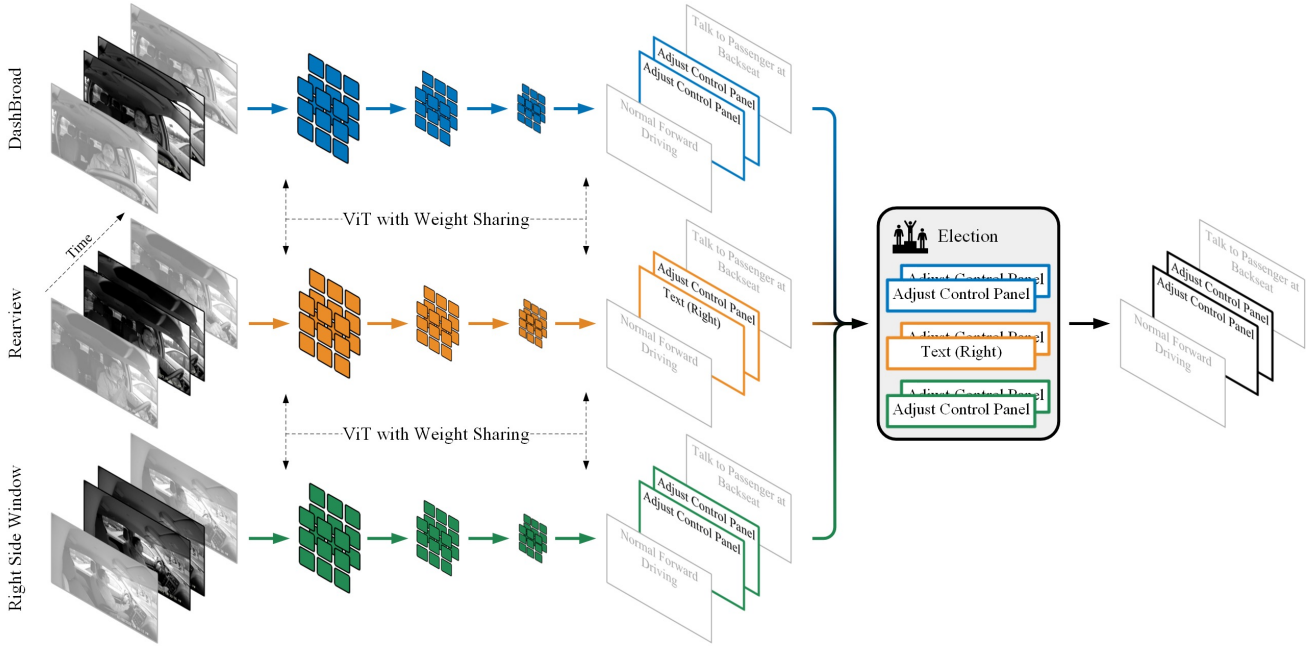
@The 7th AI City Challenge

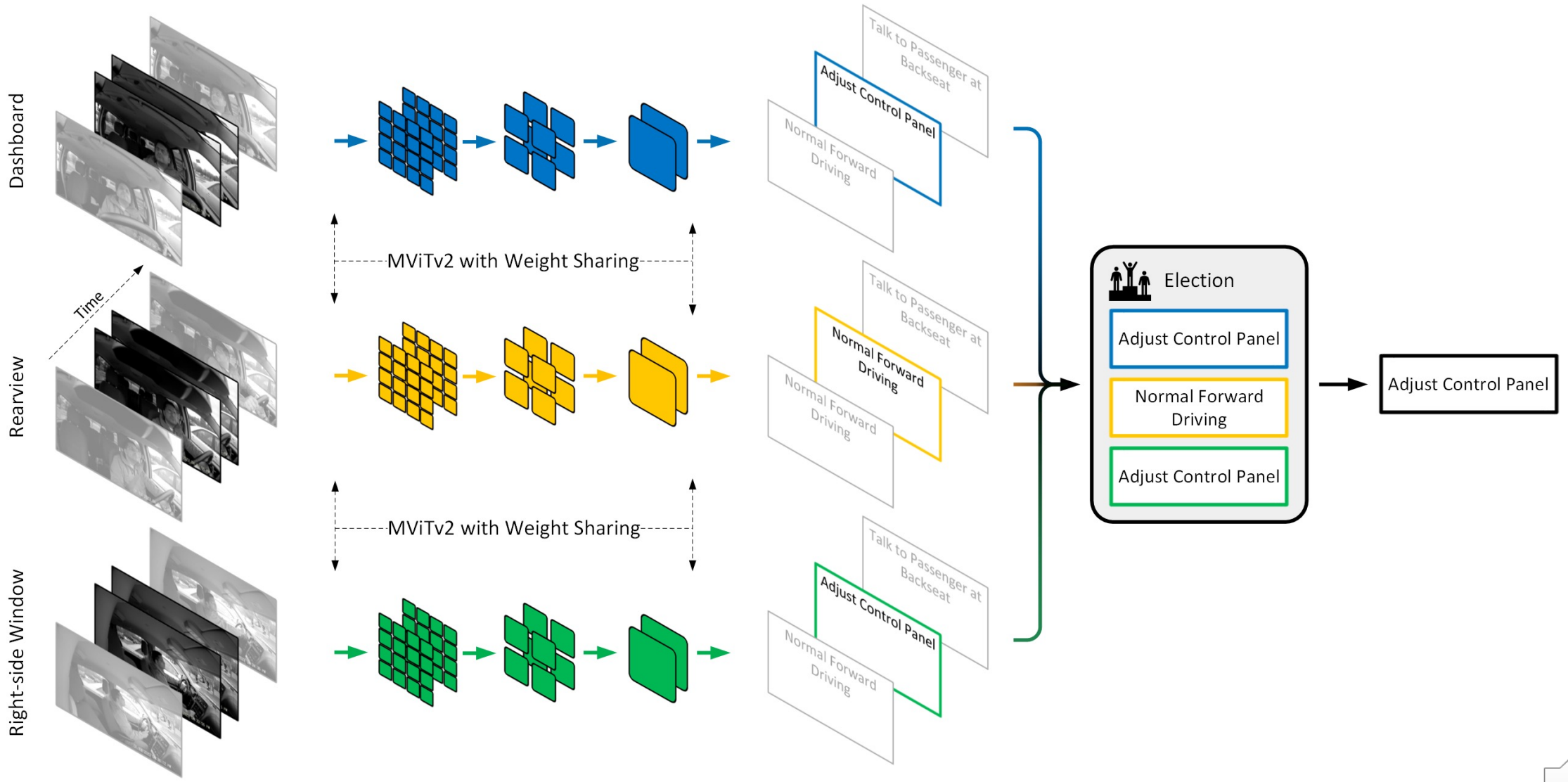


Background

- Distracted driving is a major cause of traffic accidents
- AI City Challenge 2023 has released a comprehensive dataset and organized a competition on naturalistic driving action recognition
- Our goal is to accurately determine the start and end times and identify the specific actions performed by a driver in each video, using input from multiple camera views.

Dashboard **Rear-View** **Right-Side-Window**

Methodology - Overview



Li, Yanghao, Chao-Yuan Wu, Haoqi Fan, Karttikeya Mangalam, Bo Xiong, Jitendra Malik, and Christoph Feichtenhofer. "Mvitv2: Improved multiscale vision transformers for classification and detection." In *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*, pp. 4804-4814. 2022.

Election Stage - Overview

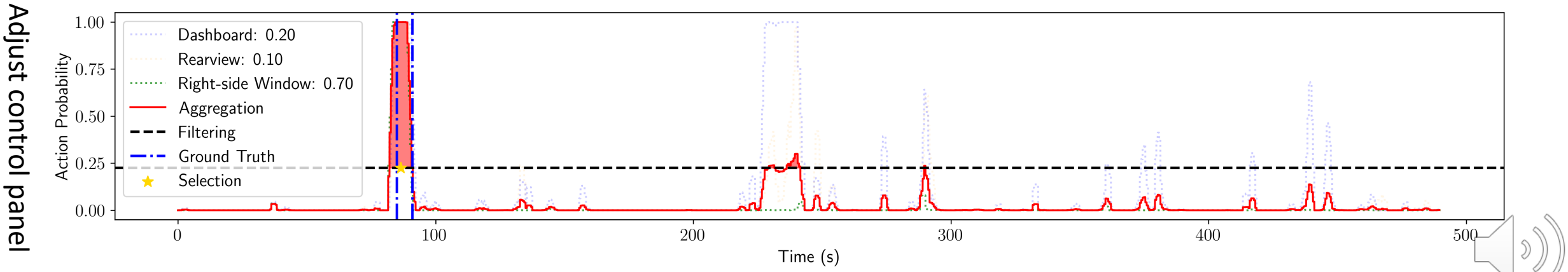
- Input: $\mathbf{p} \in \mathbb{R}^{T \times |\mathcal{C}| \times M}$
- Four steps:
  - Aggregation (AGG)
  - Filtering (FLTR)
  - Merging (MRG)
  - Selection (SEL)

Election Stage – Aggregation (AGG)

- Fuse information from various camera views

- Applies convolution operation to the input probability matrix using convolution kernels

- Convolution kernels weight information from each camera view differently for each action category

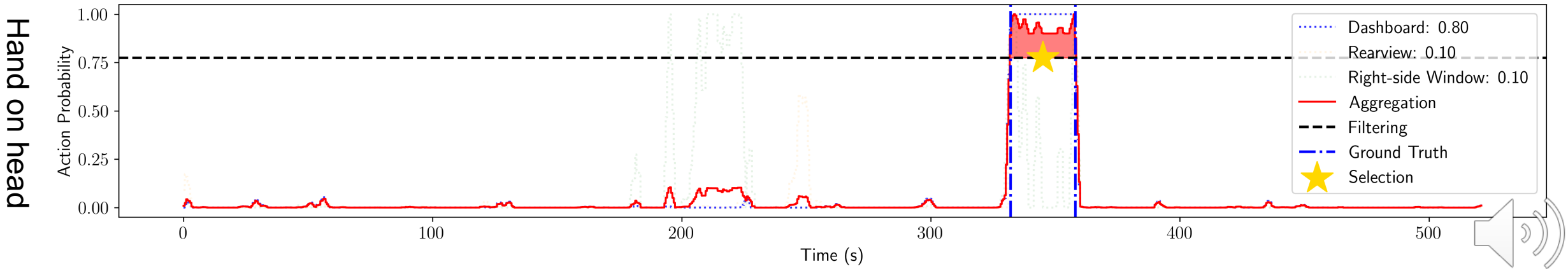


Election Stage – Filtering (FLTR)

- Identifies initial action candidates

- Extracts continuous frames with probability scores that exceed a predefined threshold for each action category

- Ensures a balance between recall and precision

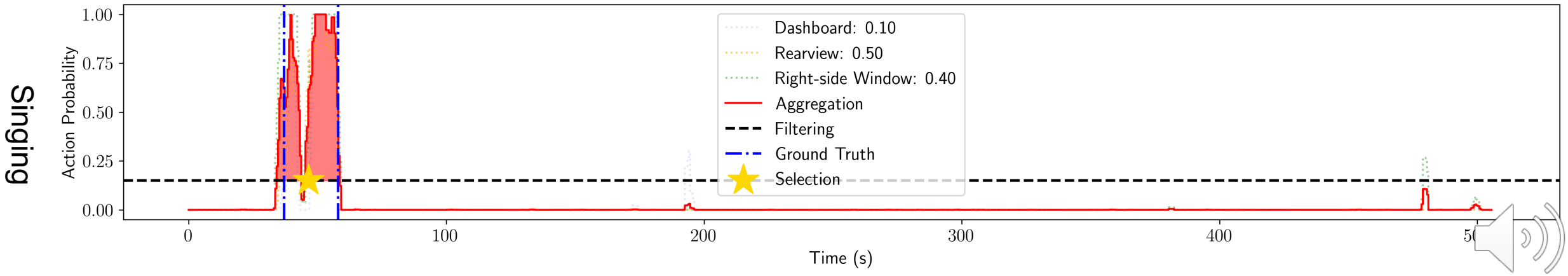


Election Stage – Merging (MRG)

- Merges clips that have a small temporal gap between them

- Iteratively compares the temporal distance between each pair of adjacent action candidate clips

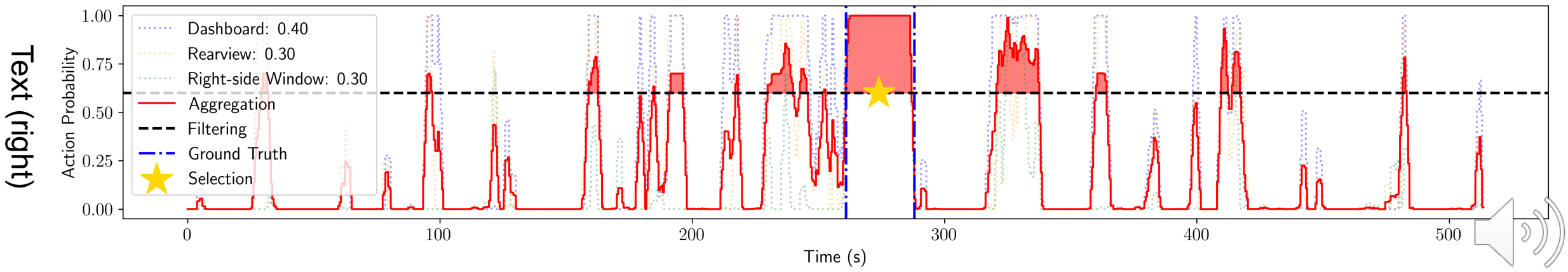
- Merges them if the distance is less than the predefined gap threshold



Election Stage – Selection (SEL)

- Computes the average score of all merged candidates for each action category

- Chooses the one with the highest average score as the final action candidates



Conclusion

- This work presents a multi-view multi-scale framework for detecting distracted driving behaviors in untrimmed videos
- The framework achieved **an overlap score of 0.5921** on the A2 test set of the AI City Challenge 2023 Track 3
- The proposed framework has the potential to aid in the development of more effective driver monitoring systems and ultimately improve road safety.