VisLoiter⁺: An Entropy Model-Based Loiterer Retrieval System with User-Friendly Interfaces

DE 02

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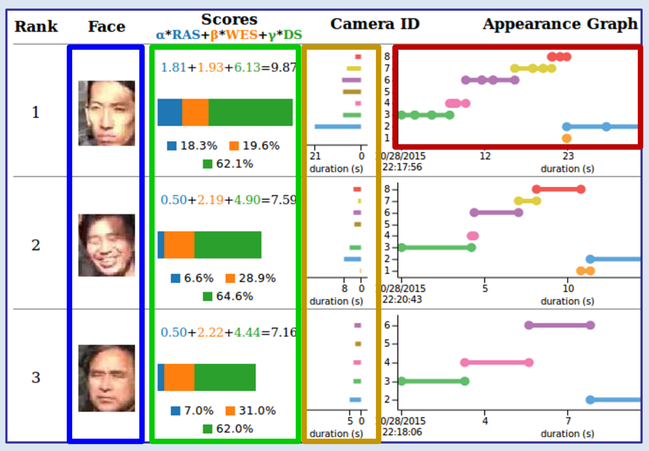
VisLoiter⁺ is a loiterer retrieval system that provides a list of loitering candidates. It gives a quick overview of people of interest and provides detailed appearance and movement information for each candidate.

➢ System Introduction



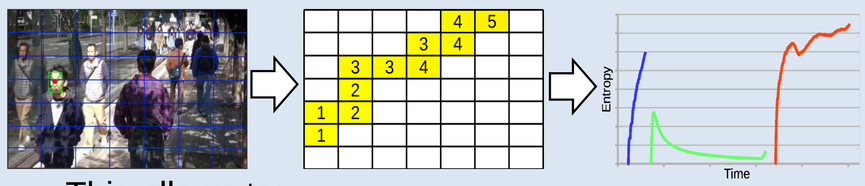
- Overview of candidates
- Composite of scores
- Cameras of interest
- Further investigation

Video Playback

- Candidate is marked
- Confirm trajectory information
- Confirm movement information

Entropy Model

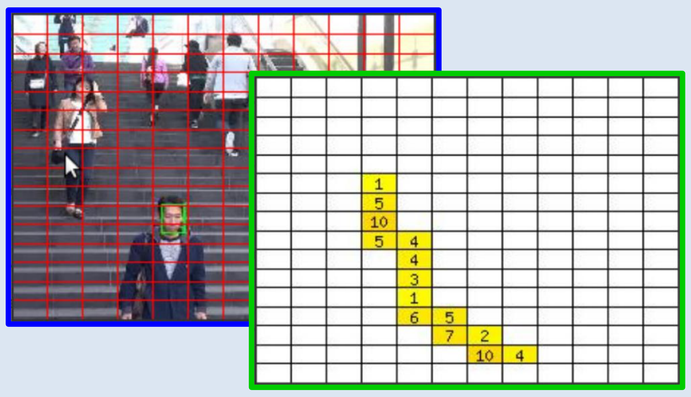
- Serve as an abstraction of movement [3]
  - Map the position of a person to a heatmap
  - Compute the entropy over the heatmap



- This allows to:
  - Quantify the amount of movement patterns
  - Distinguish different movement patterns

Heatmap Display

- Overlay the video with the heatmap grid
- View the position heatmap
- Overview of the trajectory
  - Numbers show the duration
  - Red bins indicate waiting spots



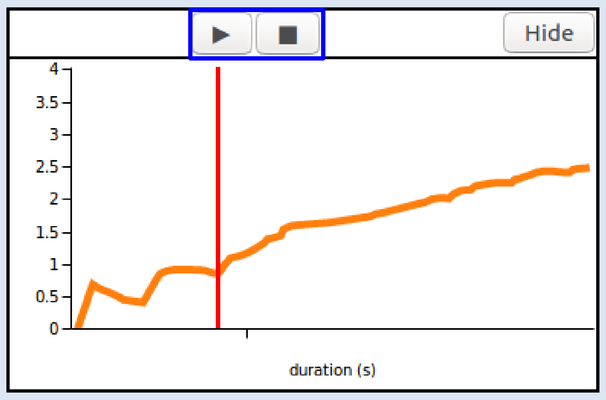
Appearance Graph

- Overview of appearances on each camera
- Hover for detailed information
  - Camera number
  - Timestamp and duration
- Click for video playback

CA #	Time	Duration	Camera
CA21 End	10/29/2015 10:07:08	0.67 s	5
CA22 Start	10/29/2015 10:07:32	4.14 s	5

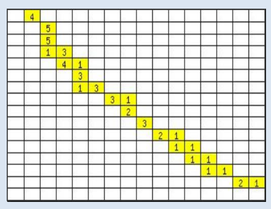
Entropy Display

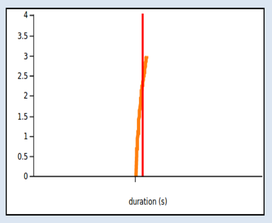
- Display the entropy over time
- Play or stop the video playback
- Observe movement patterns:
  - Increasing entropy: person is moving
  - Decreasing entropy: person is standing still



➢ Behavior Examples

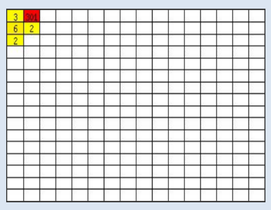
Walking

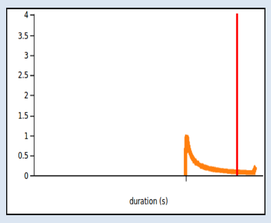




- Walk in a straight line
- Entropy rises quickly
- Short duration

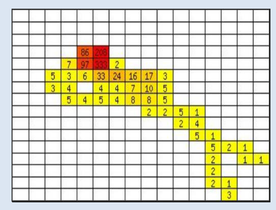
Waiting

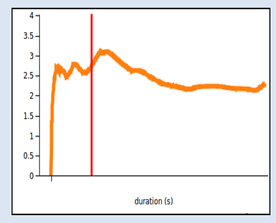




- Stand still in one spot
- Entropy lowers gradually
- Long duration

Loitering



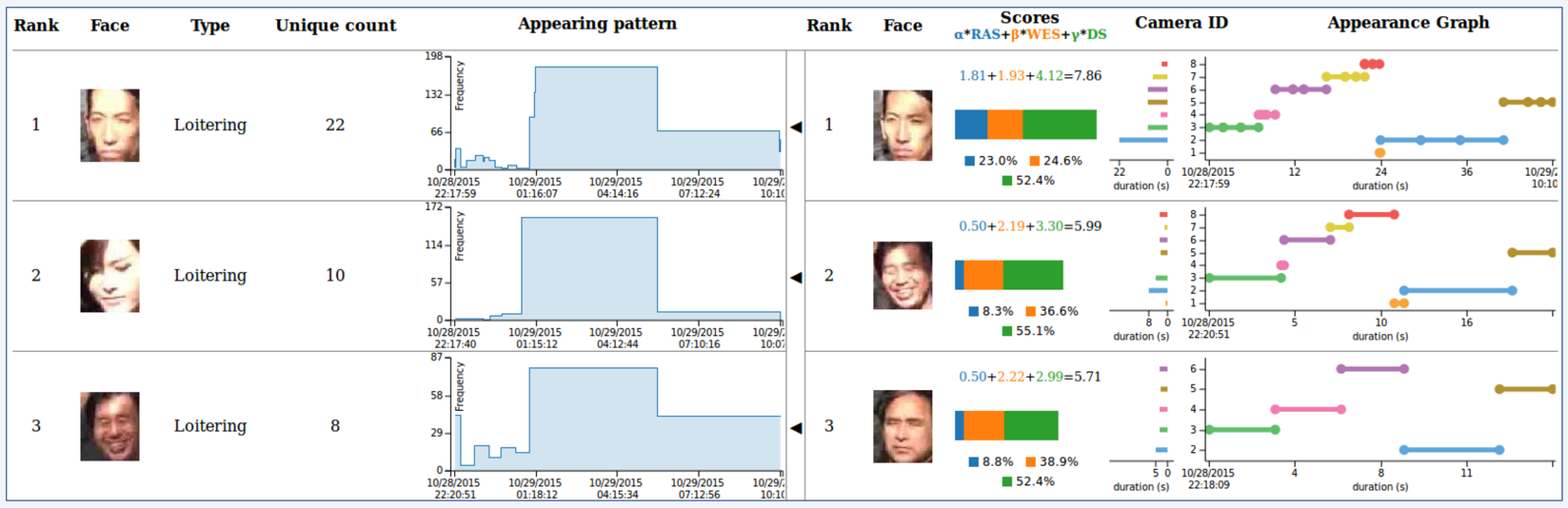


- Alternate move and walk
- Entropy goes up and down
- Long duration

➢ Improvements

➢ Watch the previous and new version side by side

VisLoiter [1]



VisLoiter⁺

Functionality	AntiLoiter[1] VisLoiter[2]	VisLoiter⁺
List of candidates	✓	✓
Uses duration of appearance	✓	✓
Consider reappearance on cameras		✓
Consider movement of candidates		✓
Overview of duration per camera		✓
Overview of appearances on cameras		✓
Allow tuning for retrieval ranking		✓
Allow video playback	✓	✓

➢ References

Demo Video

[1] J. Liu, S. Nishimura, and T. Araki. VisLoiter: a system to visualize loiterers discovered from surveillance videos. ACM SIGGRAPH, 2016.
[2] J. Liu, S. Nishimura, and T. Araki. AntiLoiter: A Loitering Discovery System for Longtime Videos across Multiple Surveillance Cameras. ACM MM 2016.
[3] M.L.T.L. Sandifort, J. Liu, S. Nishimura, W. Hürst. An Entropy Model for Loiterer Retrieval across Multiple Surveillance Cameras. ACM ICMR, 2018.