Cinematography Issues in Sports Filming summary

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Version 2.5

Artificial Intelligence & Information Analysis Lab

Cinematography Issues in sports filming

- **Framing football events**
- Filming linear sports events

Framing soccer events

- **Filming center of soccer activity:**
- Highest player concentration
- Ball position and motion

Framing soccer events

- A three-stage pipeline employing the combination of ball-/player-related information and aesthetics criteria for determining the shots to be produced.

- Only input required: a single UAV video frame.

- Main novelties:

Framing based on a RoCA - not a specific object/target.

Exploitation of present and past information only for RoCA trajectory formation - no future knowledge.

Camera control based solely on 2D visual information - no 3D information.

Framing soccer events

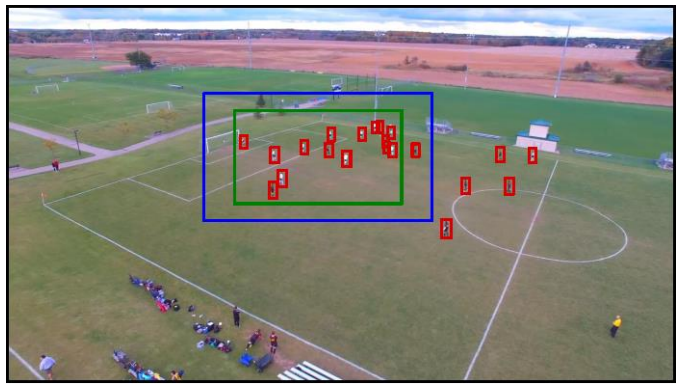
- Stage 1: Player and ball detection/tracking
- Stage 2: Region of Cinematographic Attention (RoCA) estimation at time instance t
- Stage 3: Automatic framing

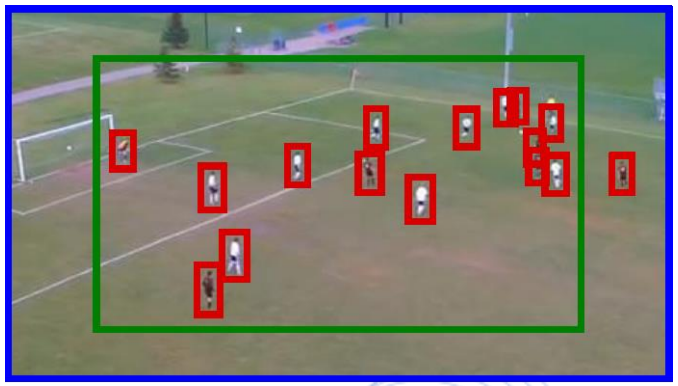
Region of Cinematographic Attention (RoCA) estimation

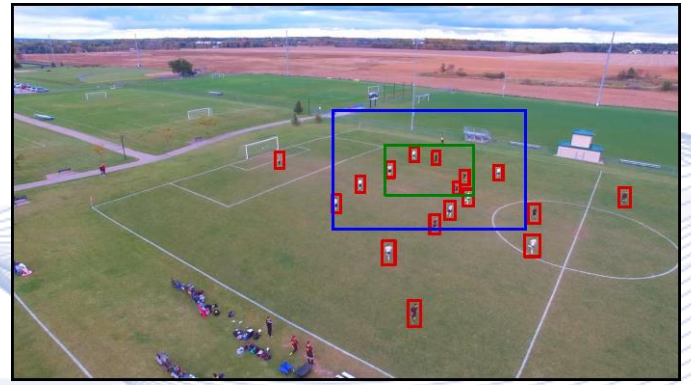
- Stage 1
  - Any player/ball detector/tracker can be used
  - Output: image ROIs

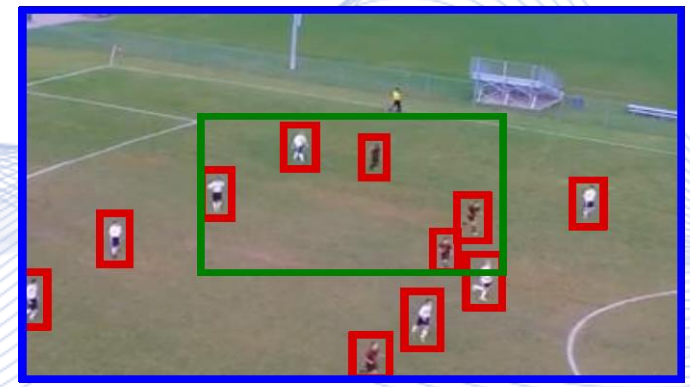
- Stage 2
  - Denote by :
    - f_t : the UAV video frame being processed at time t
    - $\mathcal{R}_{t,i} = [x_{min}, y_{min}, x_{max}, y_{max}]^T, i = 1, \dots, 22$: soccer player ROIs
    - $\overline{dx}_{t,i}$: the mean distance of player i from his $n = 3$ nearest neighbors on the x axis
    - $\mathcal{R}_{bi}$: ball ROI

Framing soccer events: results









(a) (b)

Player ROIs

Estimated RoCA

PID controller framing window

(a) UAV original camera-captured video frame, (b) virtual camera video frame

Cinematography Issues in sports filming

- Framing soccer events
- **Filming linear sports events**

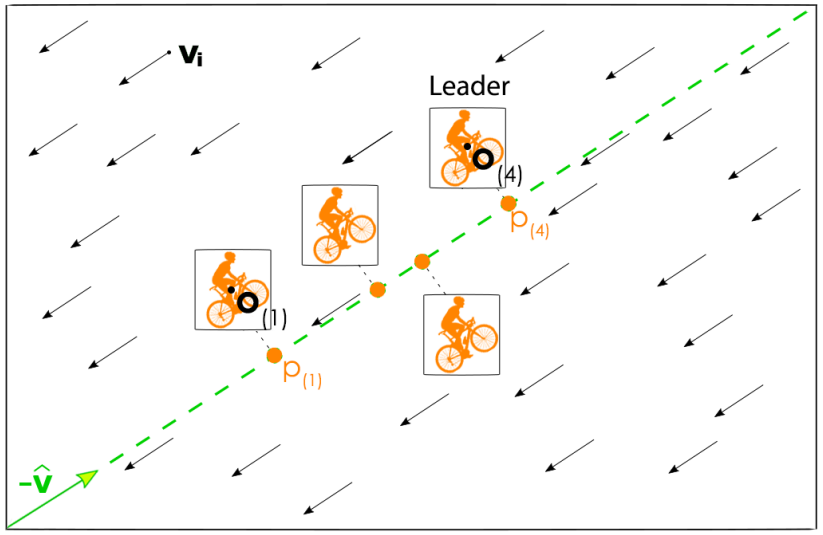
Filming linear sports events

- Linear sports events:
- Athletes are deployed linearly in space, along their motion direction.

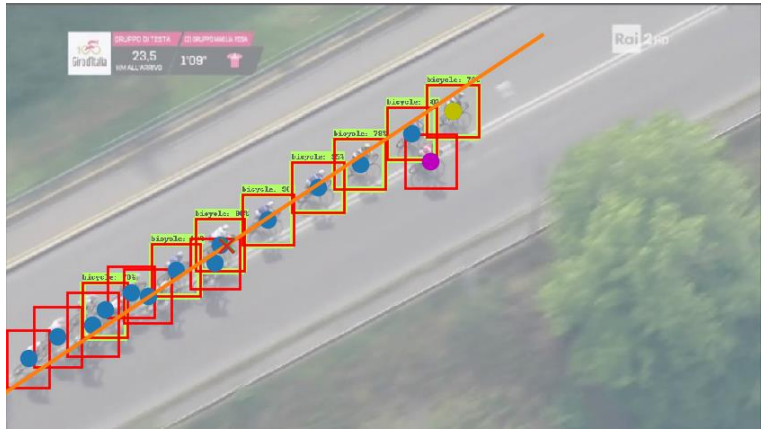
  Car/boat/cyclist races
- Filming the race leader
- Filming the moving athlete ensemble
- Breakaway detection.

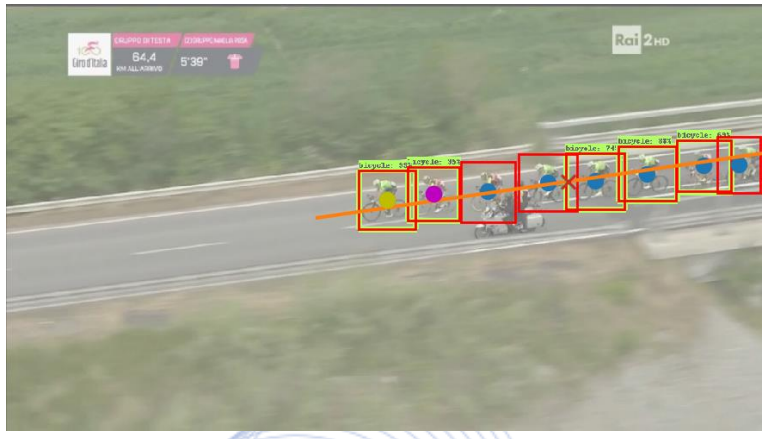
Leader and Breakaway Detection

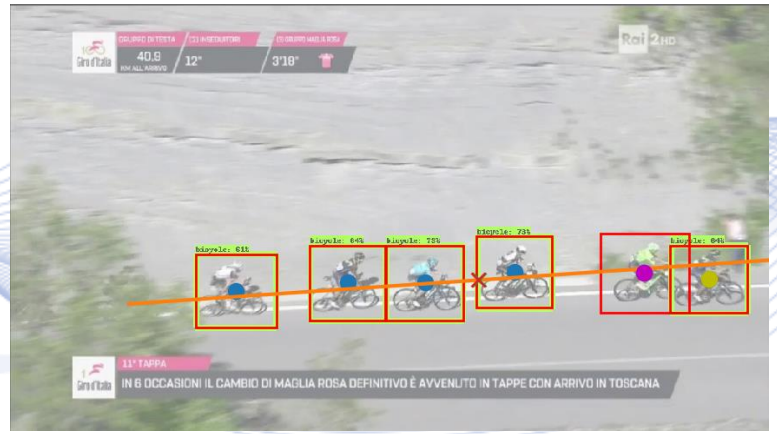
- The ordering of the targets/athletes can be easily achieved by projecting the target ROI centers on $\hat{v}$.

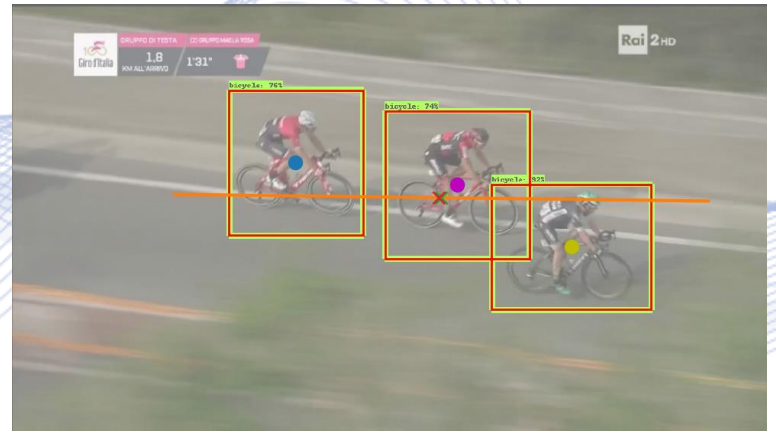


Leader and Breakaway Detection

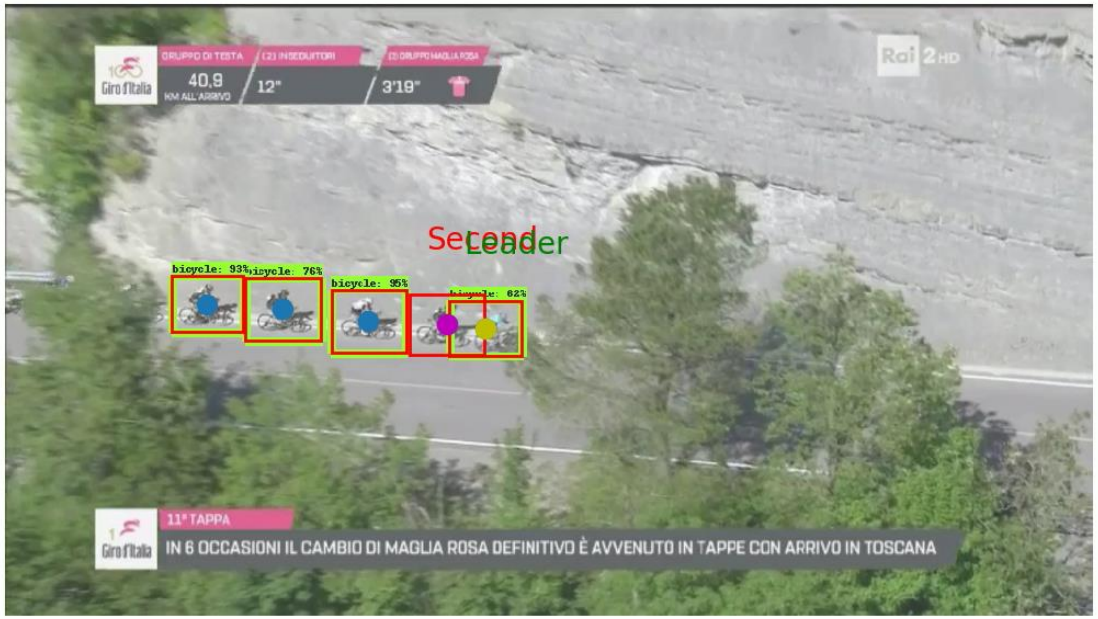








Leader and Breakaway Detection



Leader and Breakaway Detection

- A breakaway is the event where, starting from a spatially compact racer group, one accelerates and distances fast from the rest of the athlete group.
- The breakaway detection problem can be solved by introducing additional metrics and constraints.

Bibliography

[PIT2021] I. Pitas, “Computer vision”, Createspace/Amazon, in press.
[PIT2000] I. Pitas, Digital Image Processing Algorithms and Applications, J. Wiley, 2000.
[SZE2011] R.Szelinski, “ Computer Vision ” , Springer 2011
[HAR2003] Hartley R, Zisserman A. , “ Multiple view geometry in computer vision” . Cambridge university press; 2003.
[DAV2017] Davies, E. Roy. “Computer vision: principles, algorithms, applications, learning ”. Academic Press, 2017
[TRU1998] Trucco E, Verri A. “Introductory techniques for 3-D computer vision”, Prentice Hall, 1998.
[PIT2017] I. Pitas, “Digital video processing and analysis ” , China Machine Press, 2017 (in Chinese).
[PIT2013] I. Pitas, “Digital Video and Television ” , Createspace/Amazon, 2013.
[NIK2000] N. Nikolaidis and I. Pitas, 3D Image Processing Algorithms, J. Wiley, 2000.

Q & A

Thank you very much for your attention!

More material in
http://icarus.csd.auth.gr/cvml-web-lecture-series/

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