WISG16
WORKSHOP INTERDISCIPLINAIRE SUR LA SÉCURITÉ GLOBALE
ANR
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MOHICANS: Towards Modelling High-density Crowds for Assisting Planning and Safety

Emanuel Aldea

SATIE, Université Paris Sud

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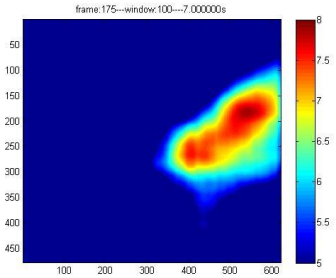
UNIVERSITÉ DE TECHNOLOGIE DE TROYES

The context of high-density crowd tracking

- Understanding pedestrian dynamics at high densities
- Understanding how instabilities may build up
- Designing safer infrastructure in congested areas: transportation, evacuation
- Surveillance, security

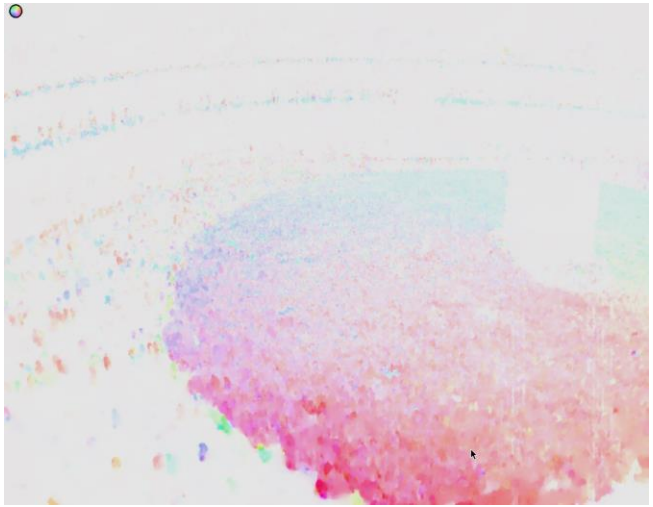


Micro-analysis: in order to model the system, the particles (pedestrians) must be tracked individually

The context of high-density crowd tracking

Crowd tracking ≠ crowd analysis

- Sometimes macroscopic descriptors are enough for analysis
- Optical flow for estimating crowd flow, detecting abnormal patterns
- Texture analysis and machine learning for approximate crowd counting and density estimation
- **Limited** power for **understanding** particle interactions, **refining** existing models, **preventing** instabilities



Is high-density crowd tracking difficult?

High-density crowd: more than 4 persons/m2

Feature	Low/med.-density crowd	High-density crowd
Occlusion	+ / ++	+++
Target size	+ / ++	+++
Detector perf.	+ / ++	+++
Target dynamics	++ / +++	+
No of targets	+ / ++	+++

Promising perspectives (1)

Redundant information

- Multiple camera networks (mostly for occlusion problems)
- Other sensors (RFID, phone trackers)
- Positive impact on tracking: more accurate **detections**, decreased **complexity** (fewer occluded objects)

Promising perspectives (2)

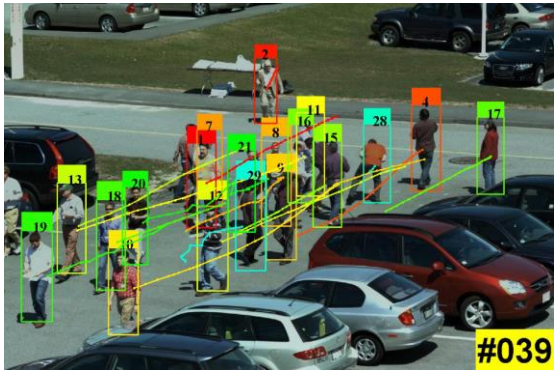
Image processing

- Improve **detector** performance for high-density scenes
- Learn specific shapes (“Ω-shape”)
- Exploit scene specificities related to appearance
- Use multiple descriptors which complement each other
  - HOG+LBP+Gabor, HOG-III etc
  - Deep learning [X. Wang]
- Rely on tracking by detection
- Positive impact on tracking: improved **detection** performance, improved data **association**

Promising perspectives (3)

Data association

- Perform opportunistic tracking (“queens”) on extended distances and propagate constraints
- Solve medium-sized NP-hard problems efficiently
- Identify approximate formulations which scale to larger sizes



Concluding remarks

Current aims

- Scientific objectives: related to multi-camera systems, detectors and trackers
- Acquiring an open-access multi-camera high-density dataset
- Support from ANR, CNRS and managers of large transportation hubs (stations, airports)
- Ethical aspects (recording, annotation, use)

Collaborations

- SATIE, Université Paris Sud
- LPP, Ecole Polytechnique
- ISIR, Université Paris 6
- Imperial College London, Crowd Dynamics
- Highly interdisciplinary work (sociology, simulation, visualization, control etc.)