Crowd Detection and Analysis summary

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Version 2.1

Artificial Intelligence & Information Analysis Lab

Crowd Analysis

- Object Detection
- Pedestrian Detection
- Crowd Detection
- Crowd Counting/Density
- Crowd Tracking
- Crowd Behavior Analysis

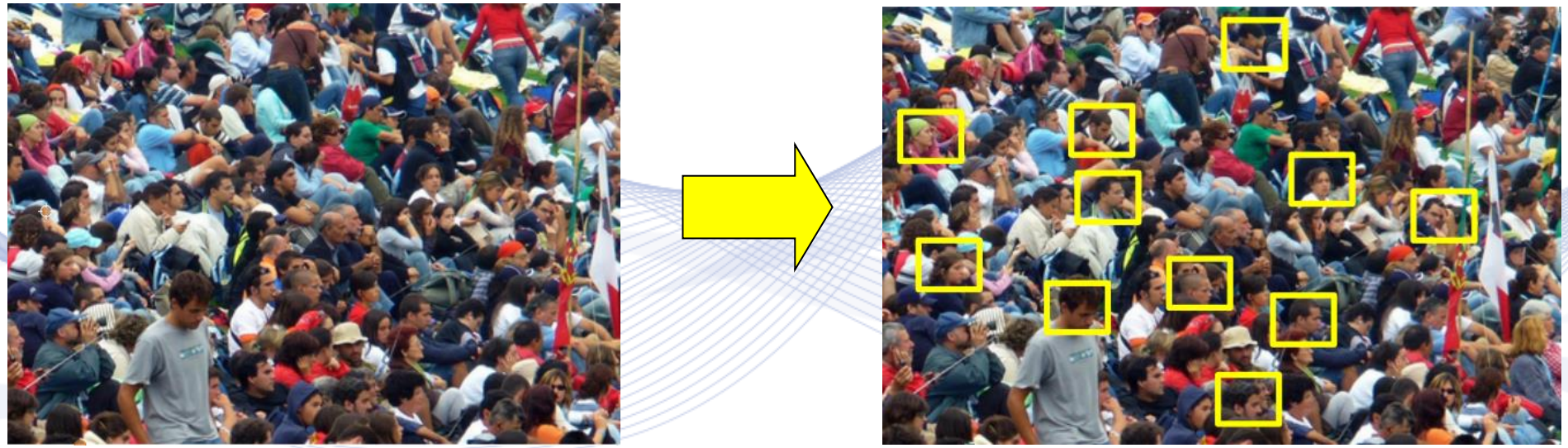
Crowd Analysis

What is Crowd Analysis?

- Crowd analysis is the practice of interpreting data on the natural movement of groups or objects.
- Masses of bodies, particularly humans, are the subjects of these crowd tracking analyses that include how a particular crowd moves and when a movement pattern changes.

Crowd Analysis

- Researchers use the data to predict future crowd movement, crowd density, and plan responses to potential events such as those that require evacuation routes.



Pedestrian Detection

- Pedestrian detection is a class of Object detection which we need to detect only person class.
- Pedestrian Detection is in a good level in practice but the problem starts when we have crowd situations

Pedestrian Detection

Pedestrian Detection Challenges:

- Various style of clothing in appearance
- Different possible articulations
- The presence of occluding accessories
- Frequent occlusion between pedestrians

Crowd Detection

What is crowd?

- The crowd is a large group of people that are gathered or considered together . A crowd may be definable through a common purpose or set of emotions:
    - a political rally ,
    - a sports event,
    - during looting
    - many people going about their business in a busy area.

Crowd Detection

- Why Person Detection is Challenging:
  - Limited resolution of images
  - Variation in clothing
  - Pose
  - Illumination

Crowd Detection

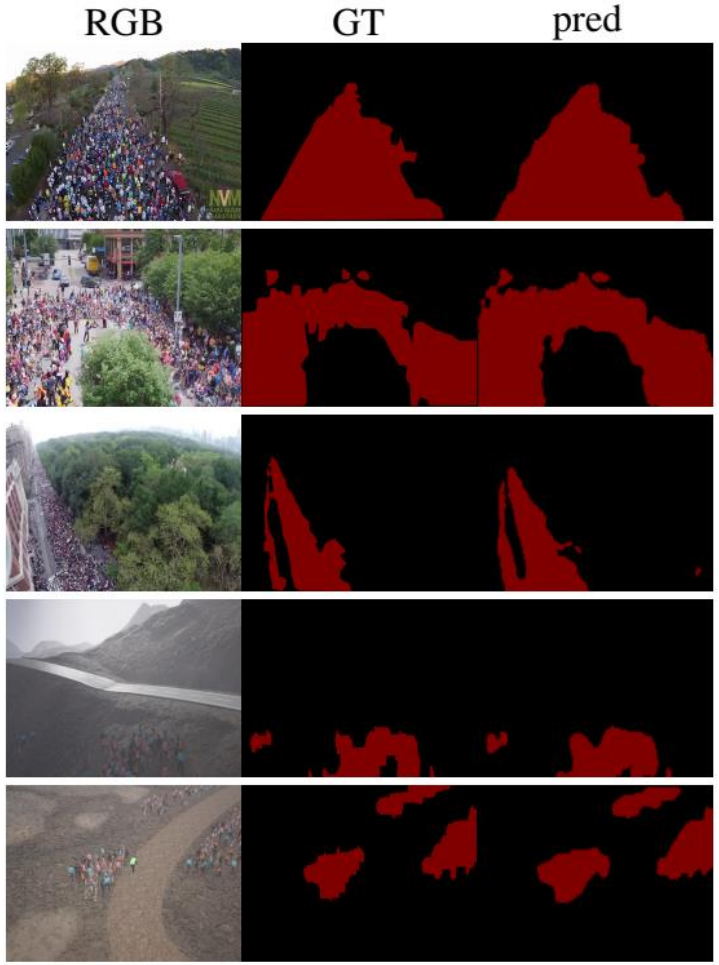
- Why Person Detection is Challenging:
  - Crowd situation
  - Noise in images
  - Not good captures
  - Heavy proccess , need quick decision (Drones)

Crowd detection using semantic image segmentation

- The crowd detection problem is effectively approached using semantic image segmentation.
- If only two object classes are considered (i.e., crowd, no-crowd), semantic image segmentation corresponds to crowd detection.

Crowd detection using semantic image segmentation

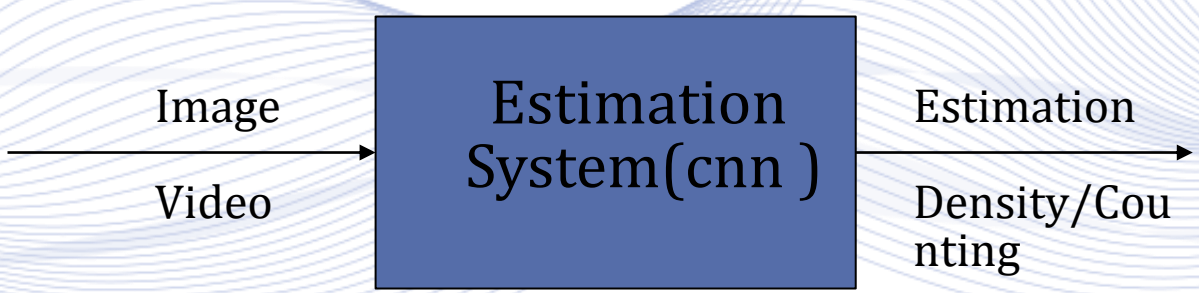
Crowd detection using semantic image segmentation



Crowd detection using semantic image segmentation

Crowd Counting/Density

Crowd counting/density is the problem of estimating the number of people in a still image or a video. It has drawn a lot of attention due to the need for solving this problem in many real-world applications such as video surveillance, traffic control, and emergency management.

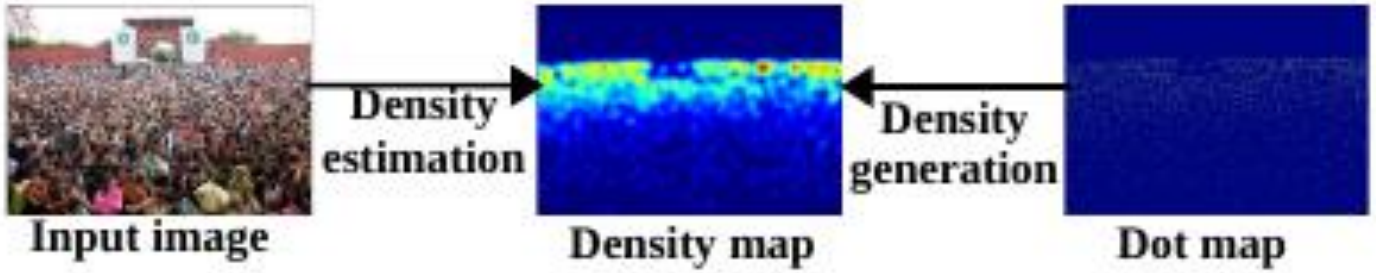


Crowd Counting

Crowd counting can be a byproduct of face detection.

Crowd Counting

- Crowd counting can also be formulated as a density map estimation problem.
- A crowd density map also provides location information about the crowd distribution.



Crowd Tracking

Detecting and tracking people in crowded scenes is a crucial component for a wide range of applications including:

- surveillance,
- group behavior modeling,
- crowd disaster prevention.

Crowd Tracking

Tracking individuals in a high density crowd scene is challenging for a number of reasons:

- the number of pixels on an object decreases with the increasing density of the object
- constant interaction among the individuals in a crowd makes it hard to discern individuals from one another.

Crowd Tracking

- occlusions caused by interactive object interactions result in the loss of observation of the target object.

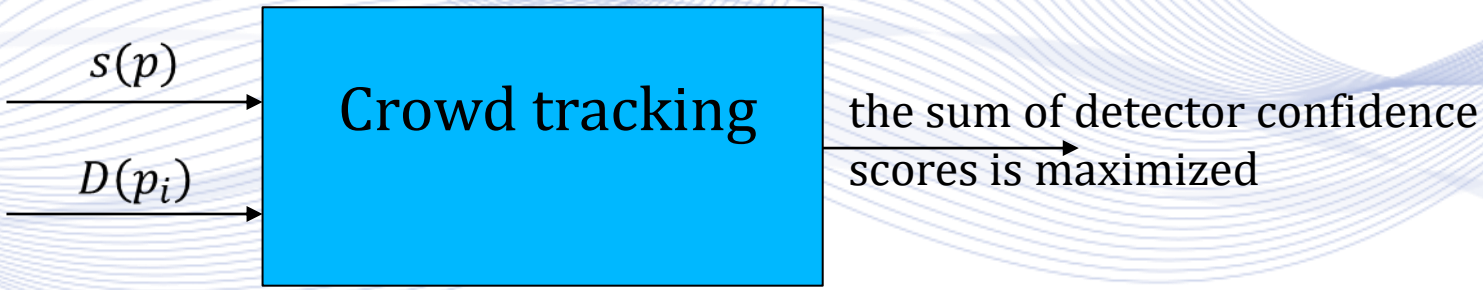
- the mechanics of a human crowd is complex as it exhibits goal-directed dynamics and psychological characteristics which in turn influence how an individual person will behave in a crowd.

Crowd Tracking

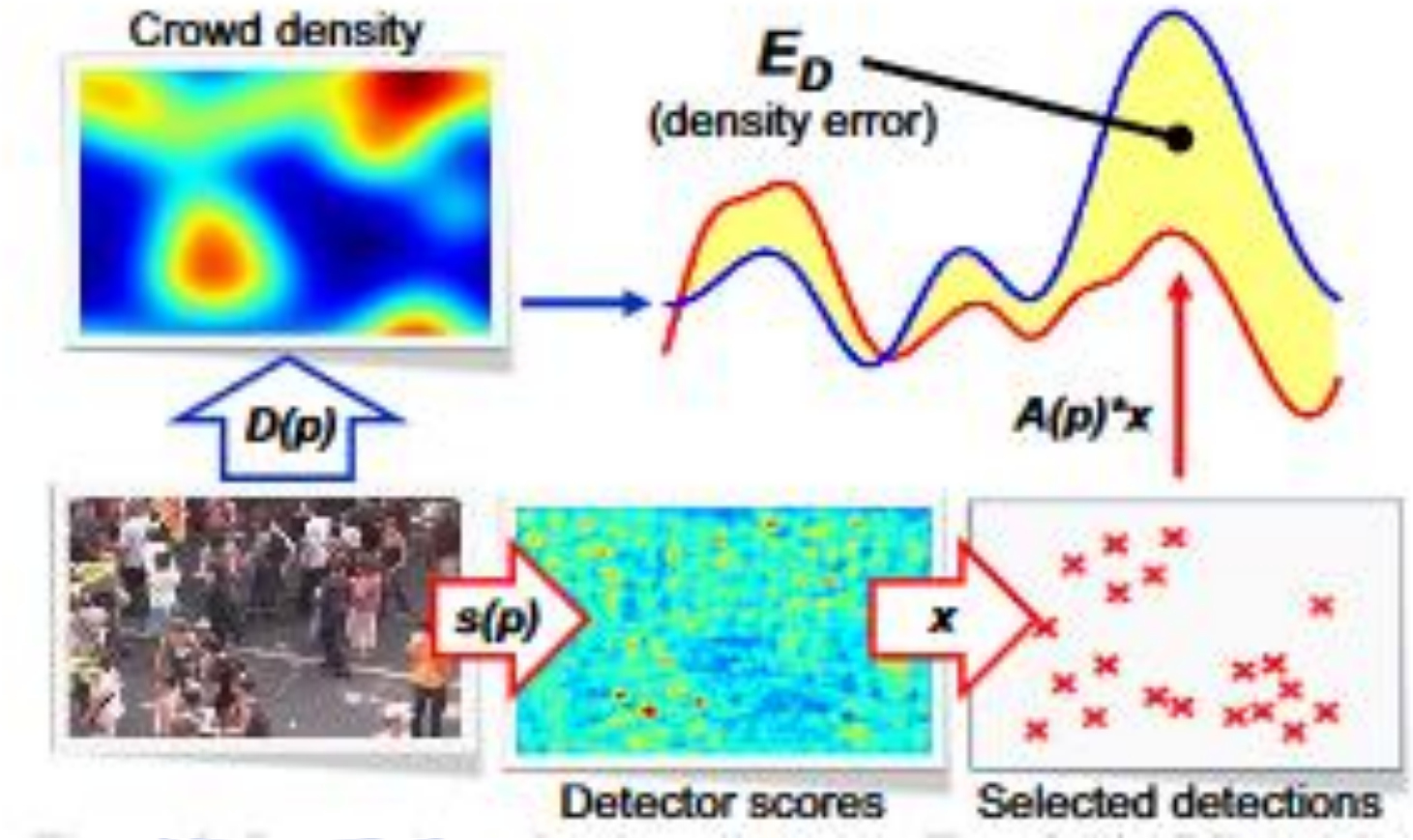
Crowd Model:

Energy Formulation:

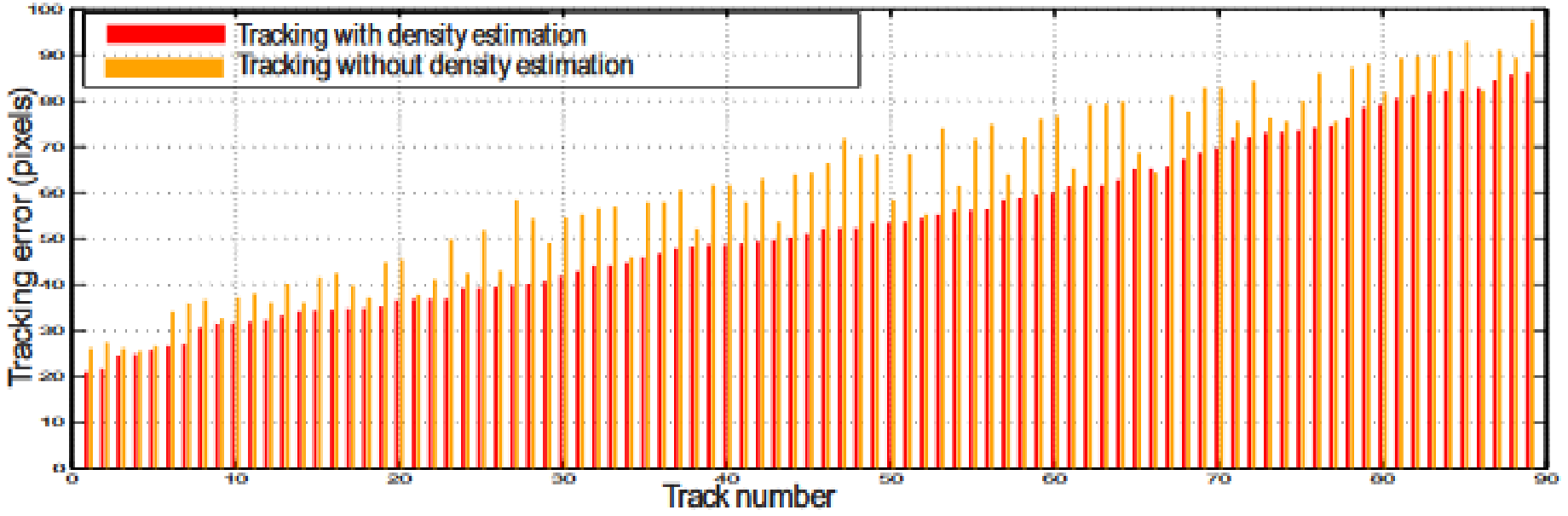
- First we assume to have a confidence score $s(p)$ of a person detector for each location $p_i, i = 1 \ldots N$ in an image.
- we are given a person density, $D(p_i)$ estimated in a window of size σ at each location p_i.



Crowd Tracking



Crowd Tracking



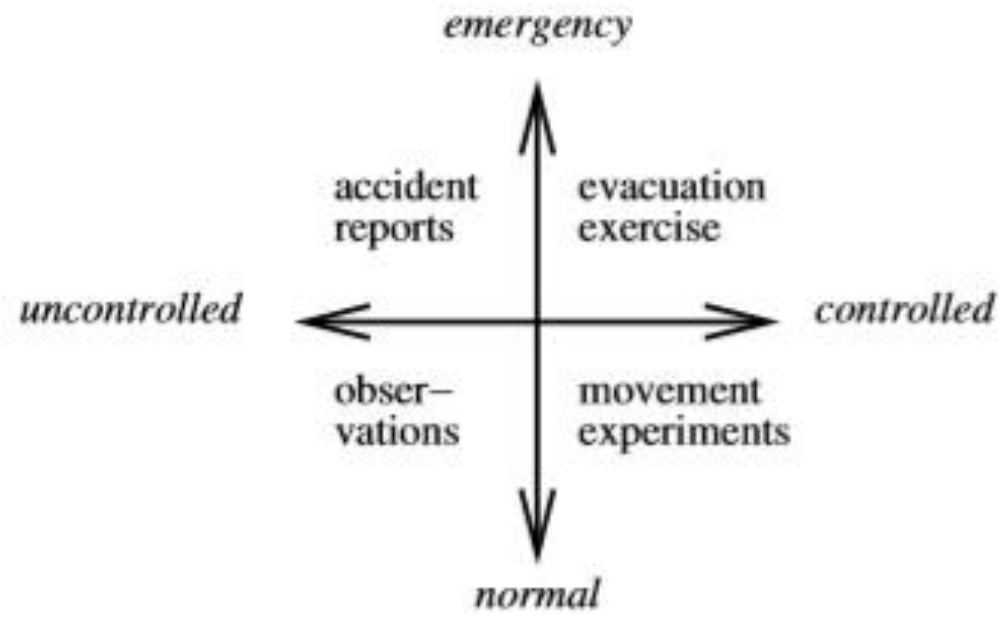
Crowd Behavior Analysis

- The behavioral analysis of a crowd is an important topic of research in computer vision. In general, the temporal information is used to estimate the behavior of a crowd in a given enviroment.

Crowd Behavior Analysis

- Why simulate crowd movement and evacuations?
  - The experimental investigation of crowd movement and especially emergency egress are limited by:
    - Practical,
    - Ethical,
    - Financial,
    - Logical constraints.

Crowd Behavior Analysis



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Q & A

Thank you very much for your attention!

More material in
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