Bridging the Gaps between Cameras

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Goal

• The relationships between the cameras must be determined to enable integration of information from multiple views.
  – Automatically derive the topology of the Camera network
  – Tracking the targets across the “blind” area
Outline

• Problem Statement
• Previous work
• Approach
  – Learning Entry/Exit zones
  – Learning Routes
  – Find the Visible and Invisible Links
• Conclusion
Problem Statement

1- track multiple targets in one camera view field

2- combine track of a single item in multiple view fields

3- correspond the track of the object between the view field of two cameras
Previous Work

• Learning Entry/Exit zones

• Finding Path

• Extracting the network of cameras
  – Automatic Learning of an Activity-Based Semantic Scene Model
Others

• Calibrating Cameras
  – Installation Time
  – What if the network is large

• Using Colors (Javed et al, IEEE computer vision 2003)
  – Colors are not reliable
Semantic Learning

- Reverse Engineering
Learning Entry/Exit Zones

• Clustering Entry/Exit points
  – K-Means
  – EM (Expectation Maximization)

• How many clusters do we have?
  – Run the algorithm with a large number of clusters
  – Keep the clusters with density higher than threshold
Finding a Route

- Find a match for the new trajectory
  Or
- Add a new route
  - Update the database
Route Classification
Creating Network

• Each entry/exit zone is a node
• Each rout is an edge
• Find the probabilistic links between cameras
  – Using scene semantics: entry/exit zones, stop zones, etc.
Ground Plane Map
Modeling the Gap

- Target disappear from the node $i$ with rate $n_i(t)$
- Appear at the node $j$ with $m_j(t)$
- $\alpha_{ij}(\tau) \propto C_{ij}(\tau)$
- $C_{ij}(\tau) \propto E\{n_i(t) \cdot m_j(t + \tau)\}$
Conclusions

• Automatically constructed tempo-topographical model of multi-camera network
• Completely unsupervised
• No Calibration
• Benefits for surveillance systems:
  – Plug and Play installation
  – Probabilistic track across blind region
I Have A Question