



**Berkeley**  
UNIVERSITY OF CALIFORNIA

**TROST**  
Team for Research in Ubiquitous Secure Technology  
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# Design of Distributed Tracking System for Camera Networks

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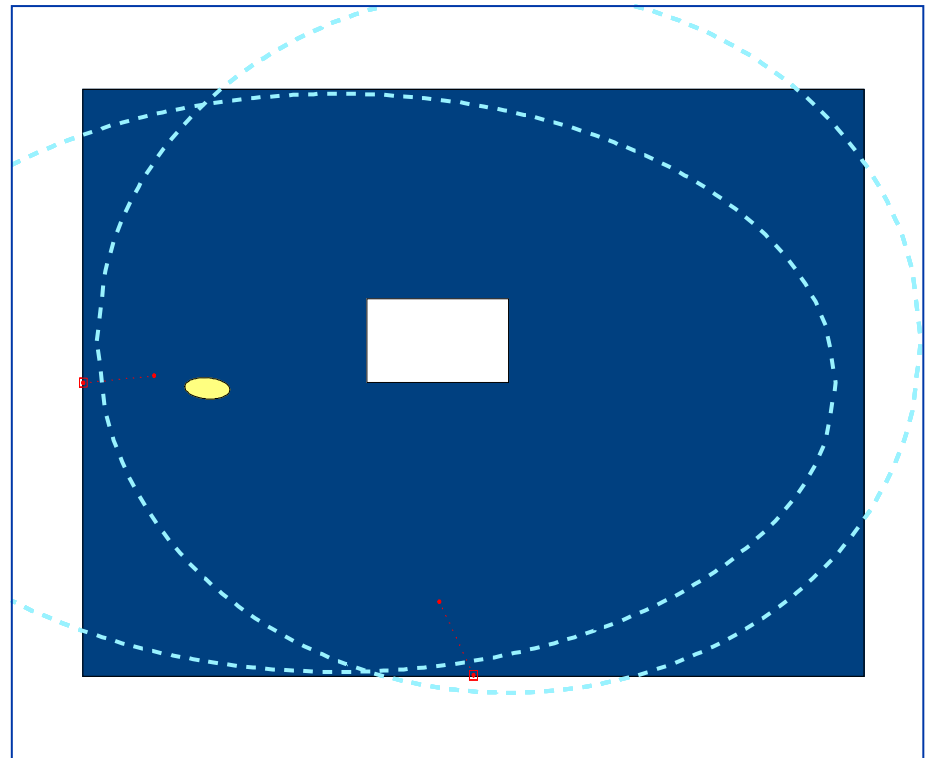
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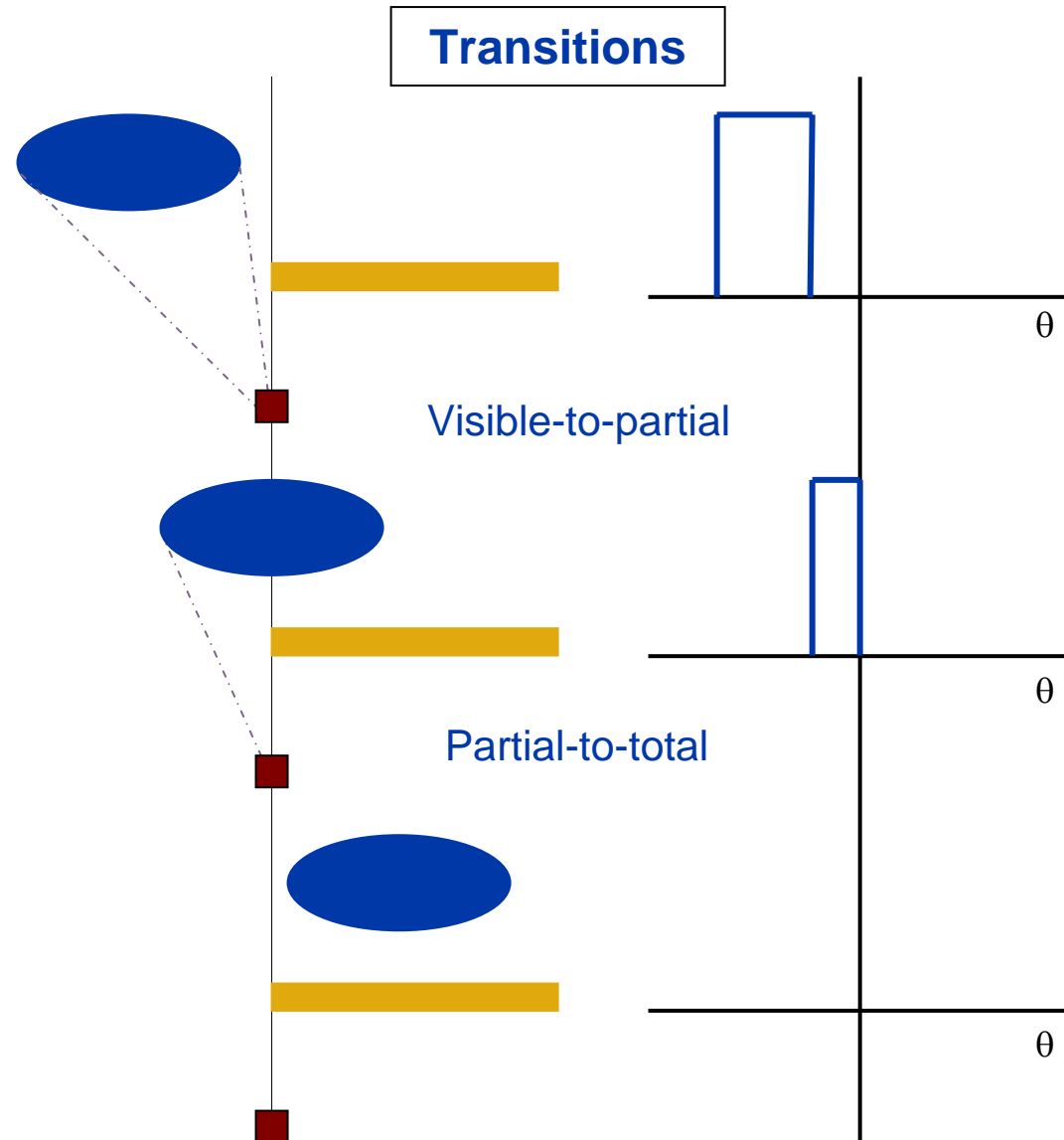
- **We are interested on the development of a tracking system for medical applications.**
- **Occlusion is one problem for tracking systems based on camera networks.**
- **We want to deal with the occlusion problem taking advantage of the information obtained from static occlusion.**
- **We want to deal with privacy issues by performing local processing and with security issues by distributing the information.**

- A 2D model has been used to simplify analysis.
- The cameras are assumed to be calibrated.
- The individual is represented with an ellipse.

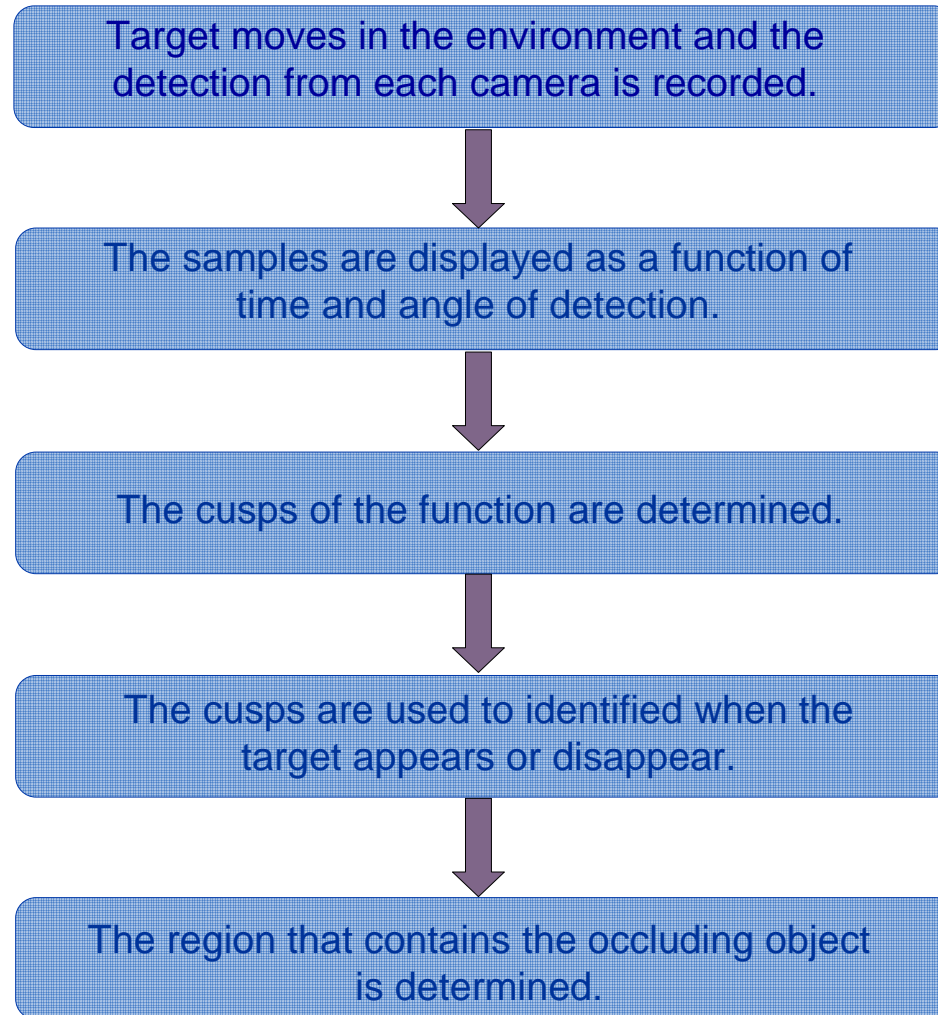


# Occlusion Analysis

- There are transitions between the different types of occlusion.
  - Total-to-Partial
  - Partial-to-Total
  - Visible-to-Partial
  - Partial-to-Visible
- Each transition has characteristics which can be identified in a time analysis.

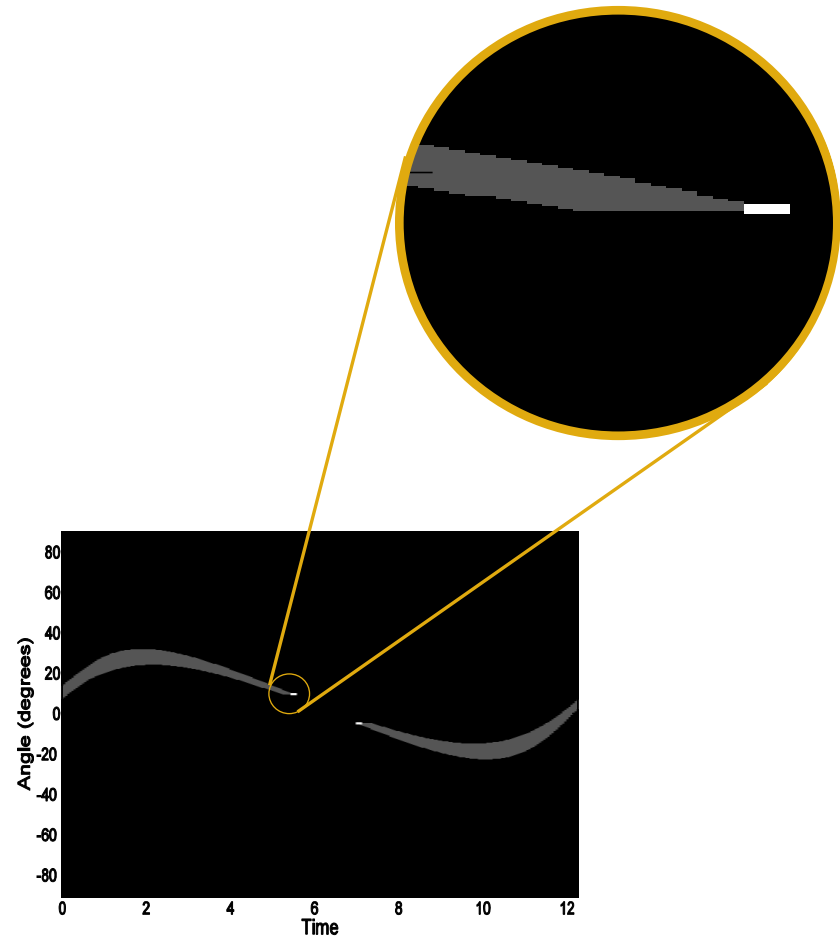


## Algorithm



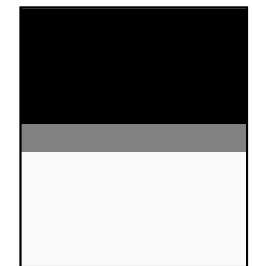
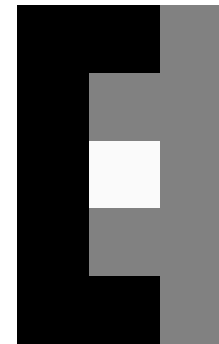
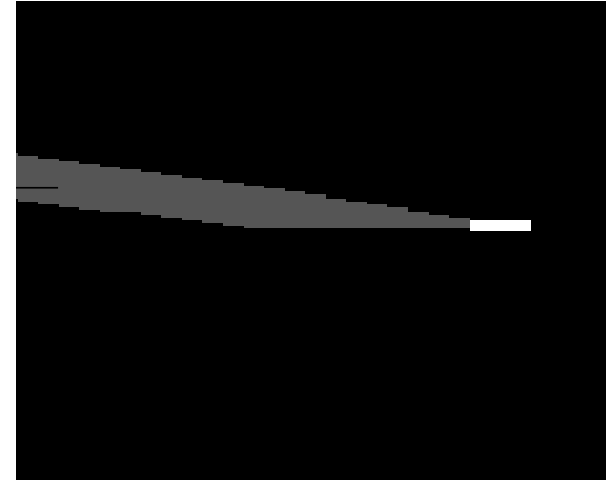
## Visibility Function

- This function depends on time and the angle in which the target is detected.
- The function presents two particular kinds of discontinuities:
  - Cusps
  - Flat Edges



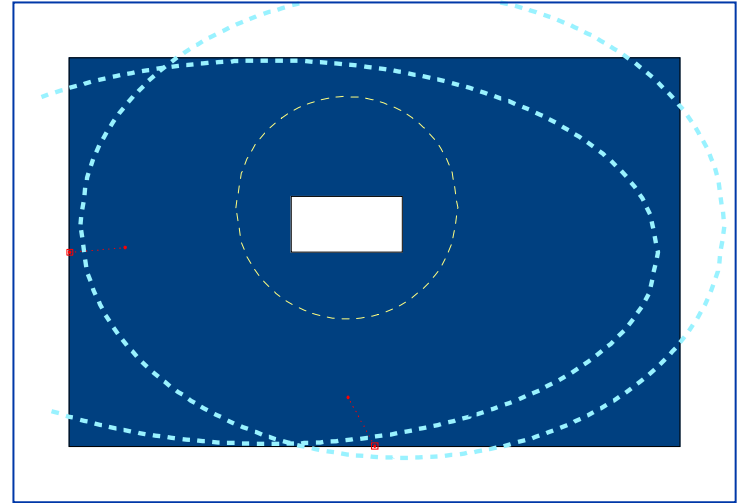
## Determining Occlusion Angles

- The cusps are used to find the boundaries of the occluding objects.
- We find the cusp by correlating a template with the visibility function.
- Another template is used to find the orientation of the flat edges.



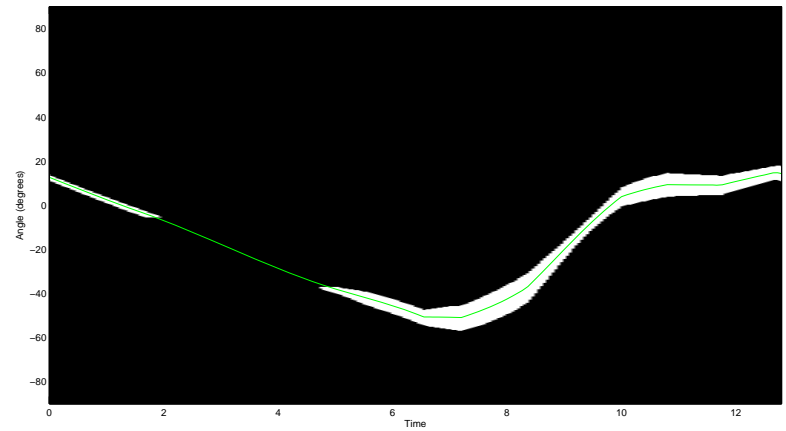
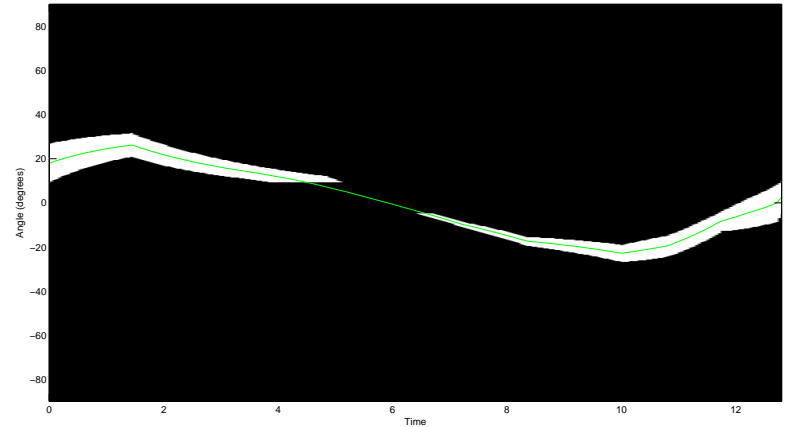
## Combining Information to localize the object

- Using the obtained angles we defined conic sections per each camera.
- Then the interception of these regions is used to locate the object.



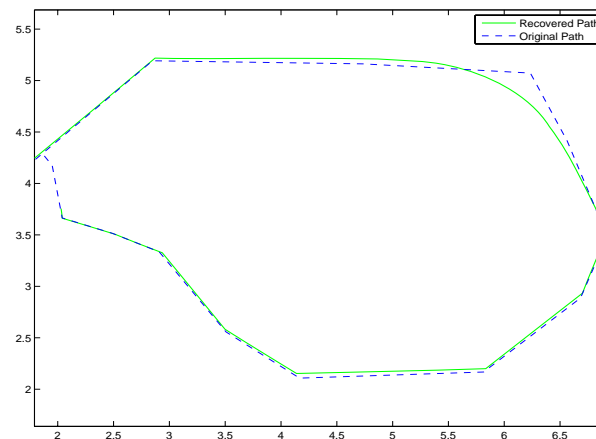
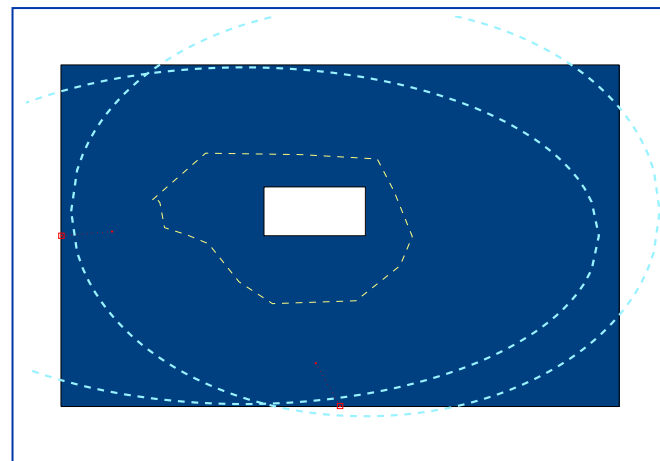
## Algorithm

- The centers of the angles are computed for each one of the cameras.
- The unreliable sections are removed.
- The missing sections are interpolated.



## Algorithm

- The center angles are used to triangulate the position of the target in the environment.
- Although the recovered path may look appropriate, it could possibly go through an occluding object.



- **Currently, the localization of occluding objects is done for one object, we want to extend it to multiple objects.**
- **The tracking algorithm is tested using two cameras, one occluding object and one target. We want to extend it to multiple cameras, multiple objects and more than one target.**
- **We hope to combined the algorithm for occluding object location with the tracking algorithm to make a more robust tracking.**

**END**



• **QUESTIONS?**