

Design of a Distributed Tracking System for Camera Networks

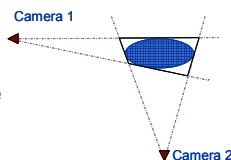
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 Faculty Mentor: Prof. S. Shankar Sastry and Prof. Ruzena Bajcsy

Abstract

Tracking systems are useful for medical applications such as the ITALH project. In this application it is especially important to have a robust and reliable system and to conserve the privacy of the user. That is why, the considered tracking algorithms deals with privacy and security issues by performing local processing and by distributing the information. To make the system reliable and robust, it is necessary to consider and understand occlusion issues. The different types of occlusion and their transitions are studied. These transitions are the basis of an algorithm to find the location of the occluding objects, and are used in a tracking algorithm to interpolate regions that are occluded to camera views.

Introduction

- In a tracking system, objects disappear and reappears due to occlusion.
- There is static and dynamic occlusion.
- Due to time consistency of static occlusion, we hope to take advantage of it.
- Each camera returns detection angles for the target and these angles can be used to find regions where the target is located under no occlusion.

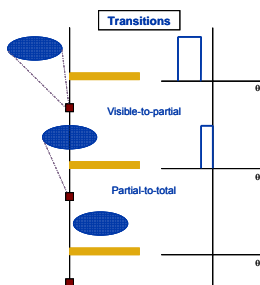


Model

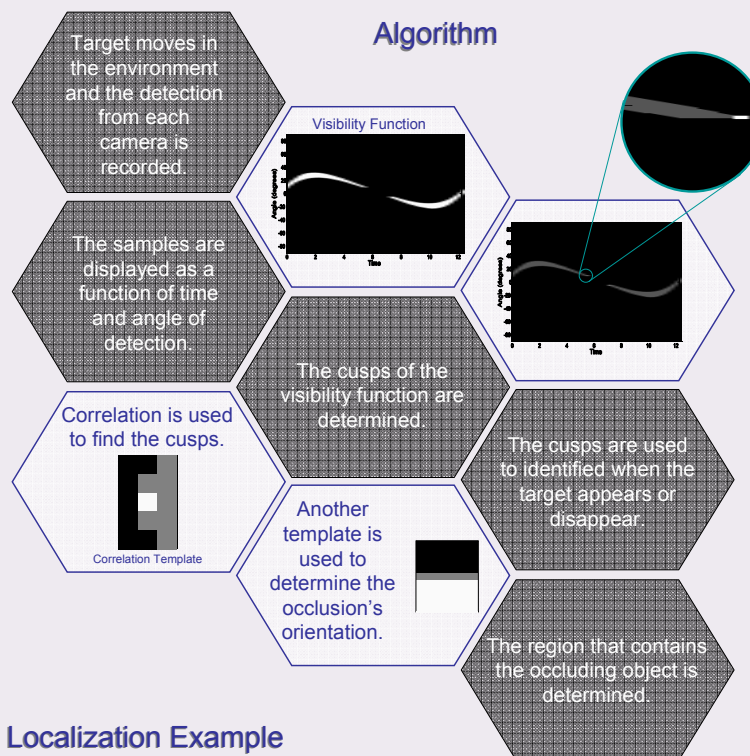
- A 2D model is used in the analysis.
- It is assumed that the camera calibration parameters are known.
- For each camera, background subtraction is done and only the detection angles of the target are returned.
- The targets are represented by ellipses.

Occlusion Analysis

- There are three types of occlusion:
 - Total Occlusion
 - Partial Occlusion
 - Non-Occluding or Visible
- There are four occlusion transitions:
 - Total-to-Partial and vice versa
 - Visible-to-Partial and vice versa

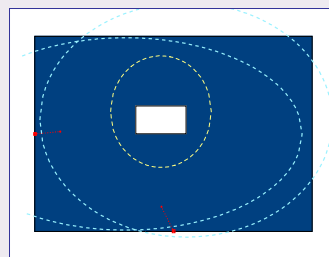


Localization of Occluding Objects

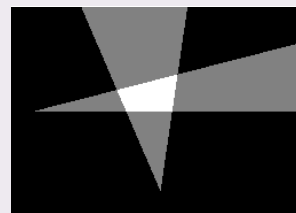


Localization Example

- The target walks around the occluding object following the yellow path.
- The algorithm returns the boundary angles of the occluding object.
- These angles are used to determine the region in which the object is located.



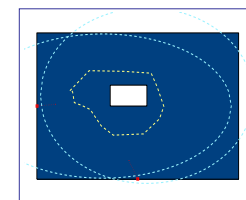
Environment



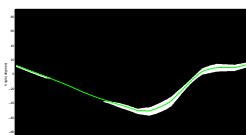
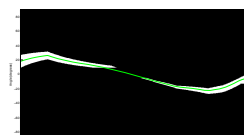
Recovered Region

Tracking

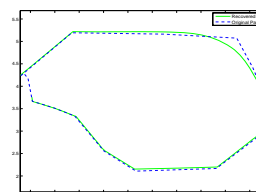
- The centers of the angles are computed for each one of the cameras.
- The unreliable sections are removed.
- The missing sections are interpolated.
- The center angles are used to triangulate the position of the target in the environment.



Environment and Path



Interpolation of Visibility Function



Path Recovery

Although the recovered path may look appropriate, it could possibly cross an occluding object.

Future Work

- 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.

Acknowledge

Thanks Edgar and Mike for all your help and SUPERB for the opportunity of being a participant of this program.