Journal Presentation

By Prateek Bhatnagar

Measuring and visualizing attention in space with 3D attention volumes

Thies Pfeiffer - Bielefeld University

Project - Medical Training with HMD

1. Real time generation of Training modules
2. 2D and 3D Generation of Heatmaps based on Eye Gaze tracking Data
    a. Purpose:
        i. Optimisation of procedures when working with trainees
        ii. Placement of Unobstructive Graphic prompts for trainees
        iii. Sister Project - Performance Evaluation of trainees

Paper

Measuring and visualizing attention in space with 3D attention volumes

Thies Pfeiffer - Bielefeld University

- Deals with creation of 3D heatmaps from 2D gaze tracking data
- Visualisation of 3D heatmap data
- Isolating regions of attention
- Discusses multiple methods for visualisation and their drawbacks

Summary and Key Result

Discusses 2 approaches:

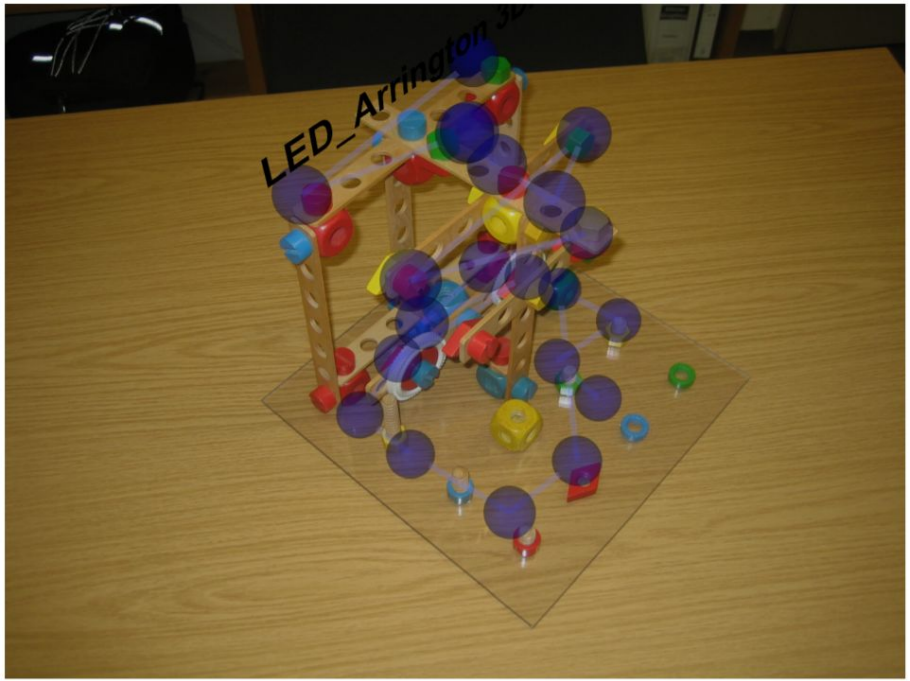
- Geometry-Based Approach
- Holistic Estimation

2 Visualisation Approaches:

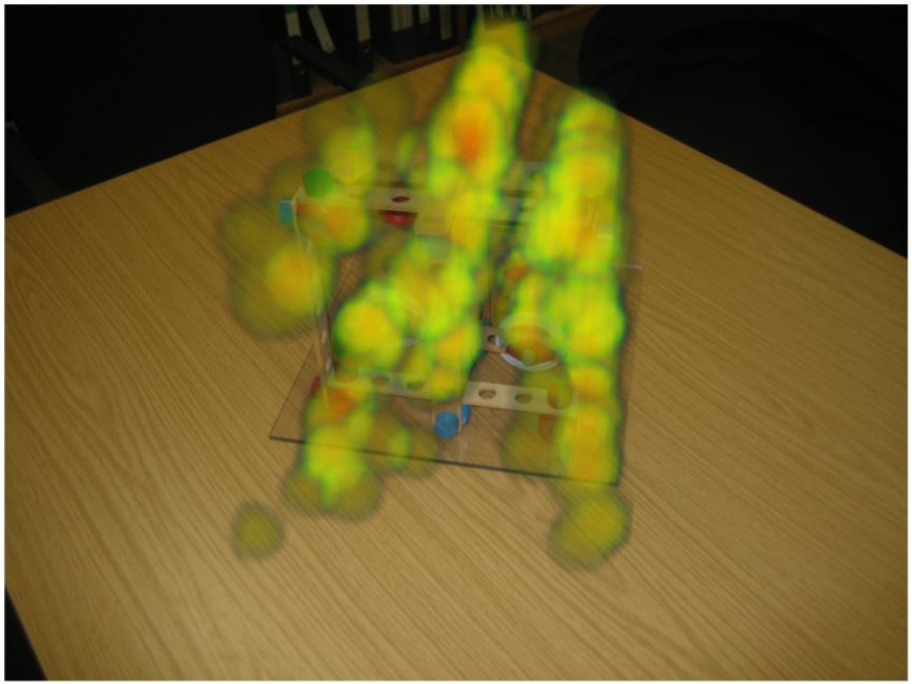
- 3D scanpaths
- 3D Attention Volumes

- Talked about their applicability to different application scenarios
- Implemented the Holistic Estimation
- Body tracking system used - outside in
- Successfully Implemented a Holistic estimation approach to create a 3D Heatmap model

Obtained Results



3D Scanpaths

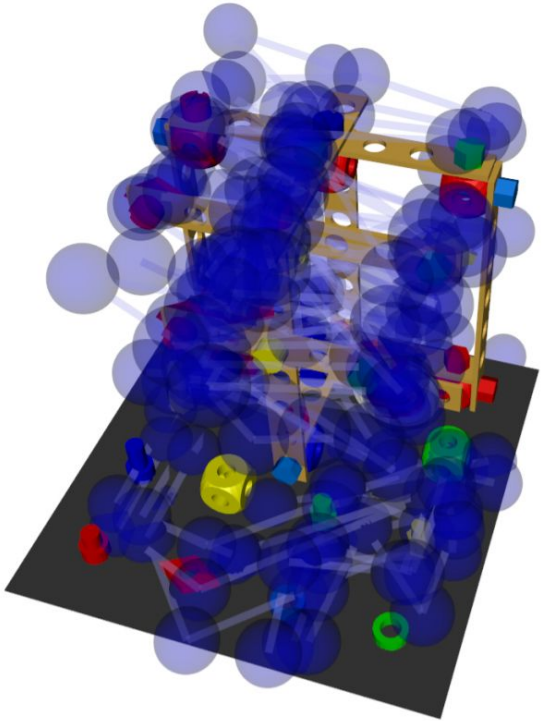


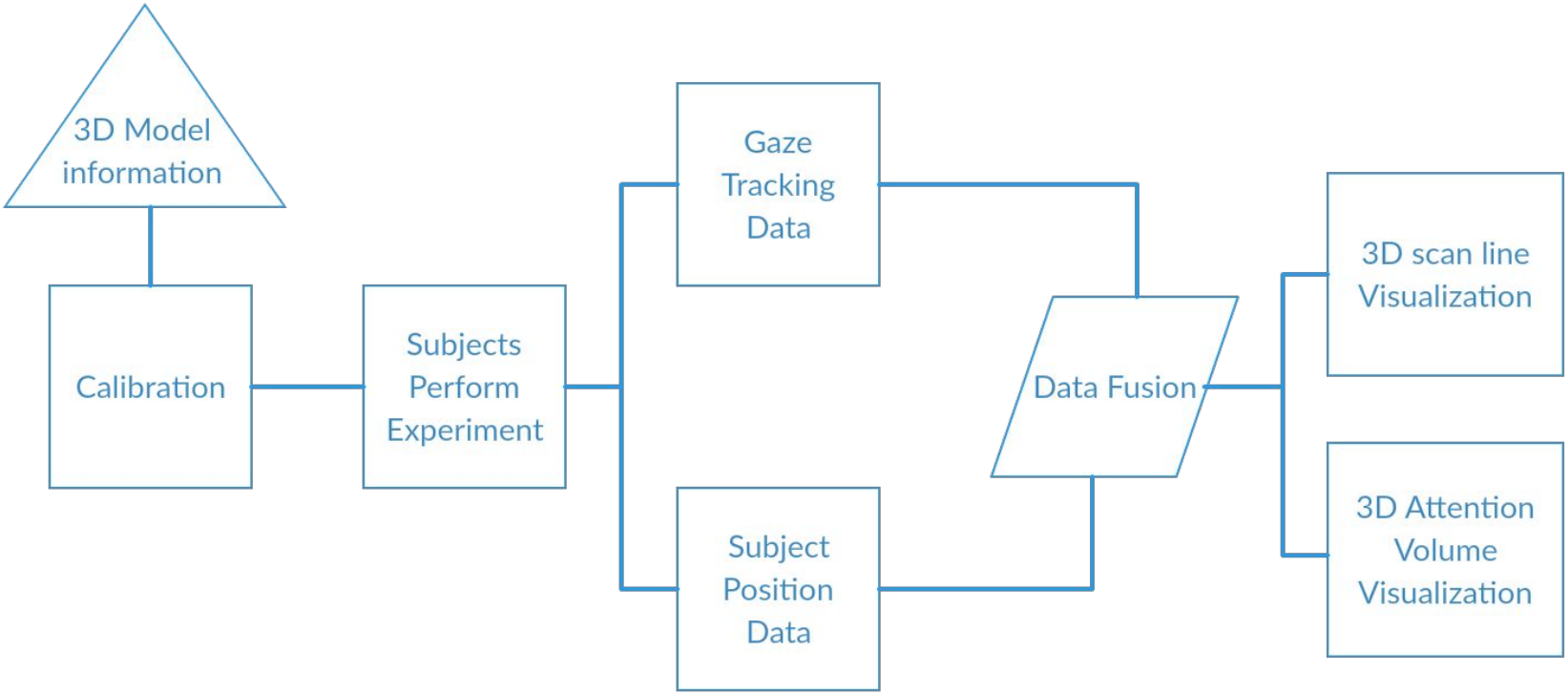
Heatmap

Background Information

- Holistic Estimation of 3D points
  - Disregards the 3D geometry of the target point
  - Instead uses 2 sources of information - i.e in this case 2 eye gaze tracking systems to obtain the 3d point in space being viewed to perform a triangulation to estimate the point position
- 3D Scanpaths
  - Use circles (2D) or spheres (3D) to indicate locations of interest
  - Regions of interest are connected using straight lines
  - The more “Interest ” in a region the larger the diameter of the circle/sphere
  - Only suitable for observing single subjects actions rather than integrating multiple observers cases

Problem observed with 3D Scanpaths





Procedure Pipeline

Discussion

Pros

- Talked about but didn't use a SLAM implementation
- Good discussion of problems faced by/ could be faced by the system
- Discussed multiple approaches to visualisation

Cons

- Had a pregenerated digital 3D model of known dimension and 3D coordinate info already
- Uses a separate tracking mechanism for the body and estimates the position of the head and eyes etc. - Outside In Tracking
- Additional calibration step to find eyes position wrt to the tracking system - points of failure
- "Hack / Cheat " used by the research is that they heavily rely on the generated 3D Model in their Visualisation Procedure
- Lacked description of the actual geometric methods used

Conclusion

- I can utilise the both the visualisation methods discussed and try to analyse which model may be suitable for me
  - Scanpath may be used for individual performance analysis
  - Heatmap may be used for aggregated data analysis
- I will try to implement both of the mapping methods i.e Holistic and Geometric as described by the paper and isolate which is better for my implementation
  - Thanks to my hardware I have that freedom - I have a binocular eye tracking
  - Will most likely go with Geometric implementation
    - Due to the SLAM capabilities of the HOLOLENS this method may be more preferable.