

Estimation of Group Attention for Meeting

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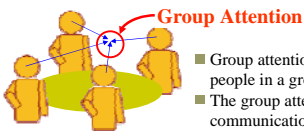
Outline

- Motivation
- Approach
- Prototype meeting capture system for estimating group attention
- Algorithm for estimating multiple group attentions.
- Summary and Future work

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Motivation

- What is group attention ?



- Group attention is the focus of attention of multiple people in a group.
- The group attention plays an important role in social communication.
- Estimating the group attention would be valuable for communication

- What is realized when the group attention is estimated?
 - It can be applied to automated camera work / video editing
- Application Area
 - Videoconferencing, E-learning, Video Archive

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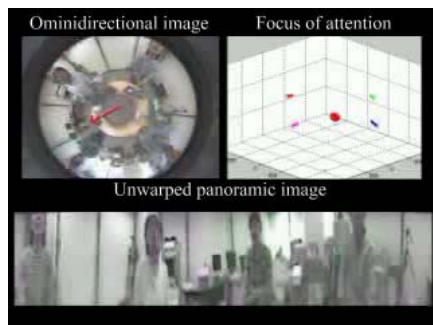
Approach

- How to estimate the group attention?
 - If people share in-focus object, all of their gaze directions should intersect at the attention point.
- How to measure gaze direction of multiple people?
 - Head orientation is measured instead of gaze direction.
- Validity of using head orientation as the substitute of gaze direction
 - Head orientation and gaze pointed at the same direction in 87% of the time [R. Stiefelwagen,2002].



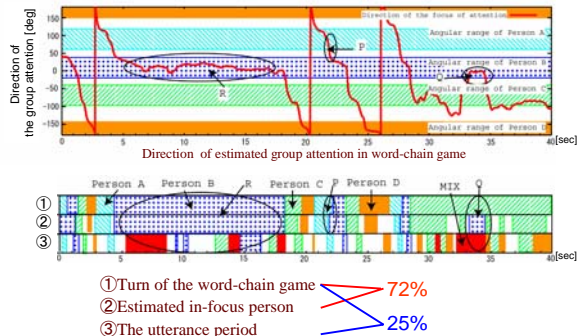
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Experimental Result: Video editing using the group attention



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Experimental Result: Group Attention vs. Speech



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Developed prototype meeting capture system for estimating group attention

Off-line system
(using motion capture system)



Application: Video editing

Online system
(using face tracking system)



Application: Automated camera work

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7

Developed prototype meeting capture system for estimating group attention

□ The camera-based face-tracking system



[System specification]
 • Passive and non-contact
 • Measurement Freq. :30[Hz]
 • Accuracy:
 Head pose Approx. 2[mm],2[deg]
 Gaze direction Approx. 5[deg]

□ System Configuration



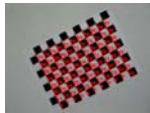
- 8 IEEE1394 cameras
- 4 PCs for face tracking
- A PC for computing the group attention

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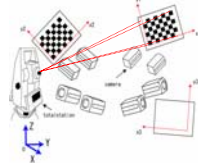
8

How to calibrate geometric parameter for the multiple face-tracking system?

□ Chess patterns are utilized as markers for estimating intrinsic parameters.



□ Extrinsic parameters of 8 cameras are estimated in unified coordinate system using "Total station".



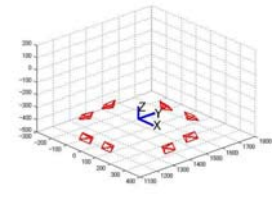
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9

Result of camera calibration



Developed meeting capture system



Result of camera calibration

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10

Result of estimating the group attention using developed meeting capture system



Situation of word-chain game

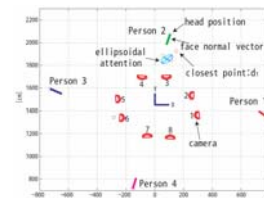


Results of tracking of multiple people

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11

Result of estimating the group attention using developed meeting capture system



Snapshot



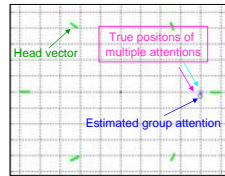
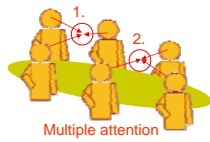
Video

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12

Algorithm for estimating multiple group attentions

- If there are a lot of people in meeting, there will be a lot of group attentions.



- Multiple attentions cannot be estimated by previous algorithm.
- The local minimum point is often estimated incorrectly.

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13

Algorithm for estimating multiple group attentions

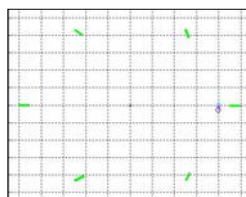
1. **To compute the cost function of M-estimator:**
 - a. To give the initial position by previously estimated group attention.
 - b. To calculate the intersection of face-normal vectors by M-estimators.
 - c. To start iteration process until convergence, the parameters are iteratively refined with the goal of minimizing the cost function.
2. **To estimate the ellipsoidal attention**
 - a. To compute variance-covariance matrix.
 - b. To calculate eigenvalues and eigenvectors.
 - c. To compute ellipsoidal attention

The two steps are iterated until new candidate of group attention cannot be found.

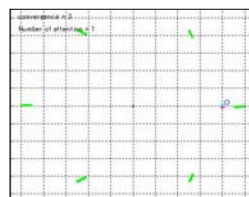
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14

Results of estimating multiple attention using new algorithm (simulation)



Previous algorithm



New algorithm

- Multiple group attentions were correctly estimated.

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15

Summary

- The prototype meeting capture system for estimating the group attention was developed.
- The method for estimating the group attention was improved in order to measure multiple group attentions.

Future work

- To improve the camera system for expanding the field of view.
- To utilize gaze direction for accurately estimating the group attention.

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16

Thank you for your attention