

# JOANNEUM RESEARCH

## Institute of Information Systems & Information Management

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## Camera Motion Detection

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# Outline

- **Common Annotation of Camera Motion Ground Truth**
  - ➔ Annotation Tool
  - ➔ Results & Experiences
  
- **Joanneum Research Camera Motion Detection**
  - ➔ Approach
  - ➔ Results

# Common Annotation of Camera Motion Ground Truth

- not part of common feature annotation
- no results from previous year available
- Ground truth required for development and parameter tuning
- Joanneum Research organized annotation
  - ➔ Provided annotation tool
  - ➔ Annotation has been joined by
    - ➔ KDDI
    - ➔ Uni Marburg

# Tool for Manual Annotation (1)

## ■ Annotation in about real-time

- while video is playing
- synchronized visualisation of video, shot boundary and camera motion views
- using keyboard
- Annotation may be edited later

## ■ Metadata input/output

- TRECVID master shot boundary reference (MPEG-7)
- MPEG-7 camera motion descriptor on each shot (using *MixtureCameraMotionSegment*)



# Tool for Manual Annotation (2)

The screenshot displays a video annotation tool interface. At the top, a timeline shows the current position at 00:01:39:29 within ShotNr: 7. The central video player shows a meeting scene with an 'LBC' logo in the background. Below the video, a control bar includes play, stop, and volume icons. At the bottom, a detailed annotation track is visible, showing a sequence of shots (Shot Nr. 3 to 11) and corresponding manual annotations such as 'PAN RIGHT', 'PAN LEFT', 'Unreliable', 'ZOOM IN', 'ZOOM OUT', 'TILT DOWN', and 'TILT UP'. A zoom level of 'minute' is indicated at the bottom left.



# Results of Manual Annotation (1)

- **40 videos of development set**

- ➔ 27.5 hours with 11,918 shots

- **camera motion annotated**

- ➔ 4,929 shots contain motion (41.4%)

- ➔ of those, 927 shots contain undefined motion (18.8%)

- **4,002 with “defined” camera motion contain**

- ➔ 4,436 pans

- ➔ 1,492 tilts

- ➔ 3,930 zooms

- ➔ that is 2.46 camera motions per shot



# Results of Manual Annotation (2)

## ■ Problems experienced by annotators

- Small amount of motion, short duration of motion
- Computer generated sequences, animations
- Editing effects such as split screen, transitions, ...
- Sequences with very short shots, time-lapse sequences
- Multiple motions per shot (simultaneously)

## ■ Questions

- Minimum duration and strength of motion?
- Shot granularity or finer?

# Results of Manual Annotation (3)

## ■ Subjectivity of ground truth

- ➔ Video 160 has been annotated in parallel by 2 groups
- ➔ Evaluation of manual annotations

Pan					Tilt				
True +	False +	False -	Prec.	Rec.	True +	False +	False -	Prec.	Rec.
52	0	27	1.00	0.66	15	1	29	0.94	0.34
Zoom					undefined				
True +	False +	False -	Prec.	Rec.	True +	False +	False -	Prec.	Rec.
45	5	3	0.90	0.94	0	2	12	0.00	0.00

## ■ Subjectivity of high-level feature annotations?

# Camera Motion Detection (1)

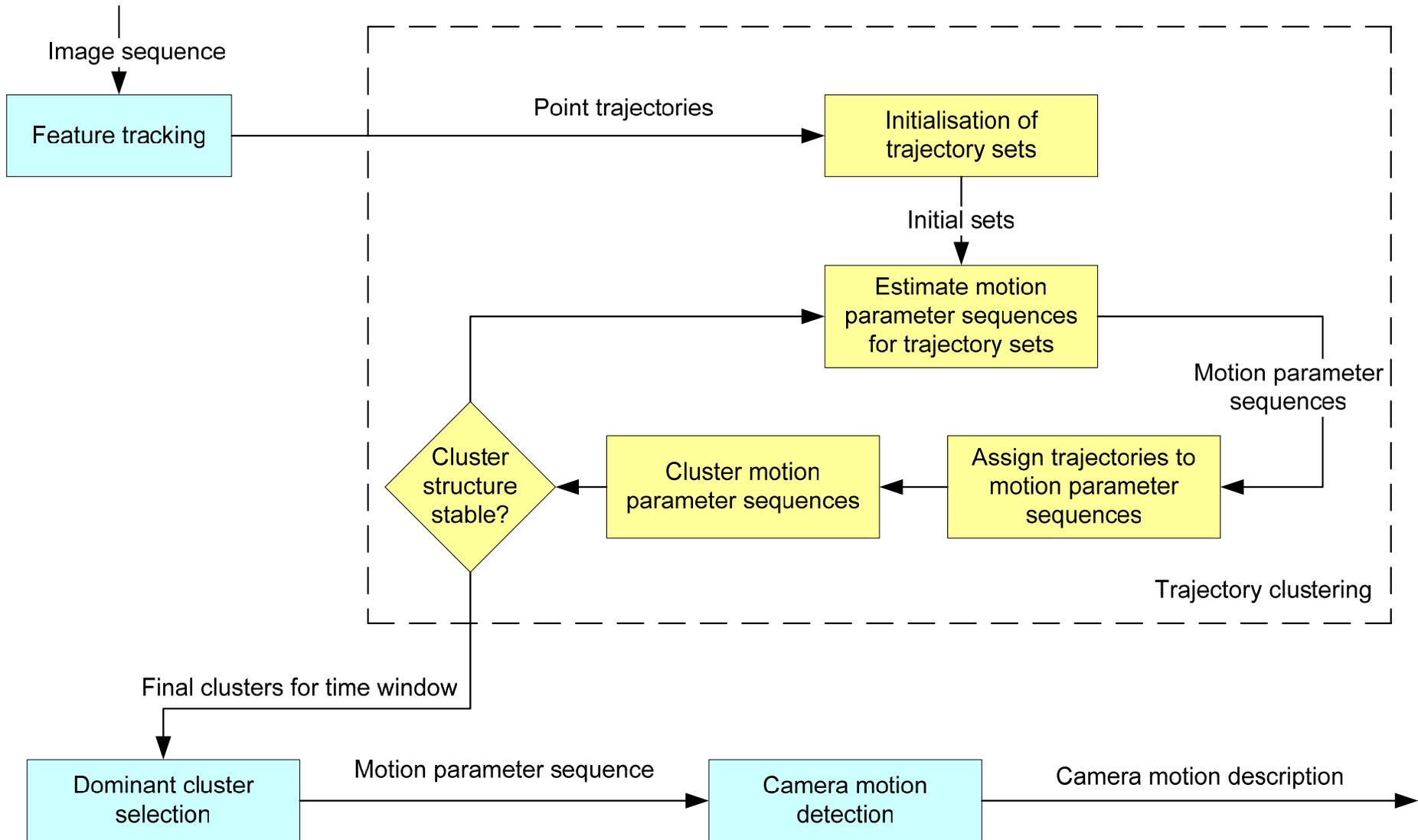
## ■ Approach

- feature tracking (LK tracker)
- Cluster trajectories based on motion (4 parameter motion model)
- Select cluster representing camera motion
- camera motion detection

## ■ Detection

- Input: sequence of motion parameters for dominant cluster
- In time window, filter motion parameters with median
- Calculate accumulated pan, tilt and multiplied zoom factor

# Camera Motion Detection (2)



# Results

- **Quite different for different features**
- **Parameters of runs**
  - ➔ Reduced thresholds for zoom, pan, slightly also for tilt
  - ➔ Same parameters for temporal extent of motion occurrence

	Pan		Tilt		Zoom		Mean	
	Prec.	Rec.	Prec.	Rec.	Prec.	Rec.	Prec.	Rec.
Run 1	0.927	0.606	0.831	0.657	0.610	0.947	0.789	0.737
Run 2	0.919	0.676	0.828	0.686	0.640	0.933	0.796	0.765

# Contact

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