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Interactive and Stereoscopic Hybrid 3D Viewer of Radar Data with Gesture Recognition

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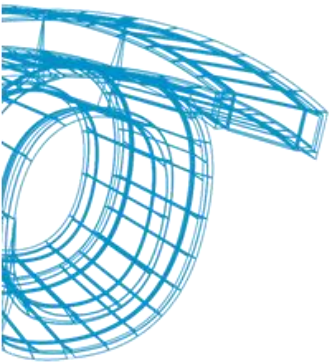
ik4 research alliance

Content



1. Motivation and Objectives
2. Representation and 3D visualization
3. Gesture Interaction
4. Experimental Results
5. Conclusions and Future Work

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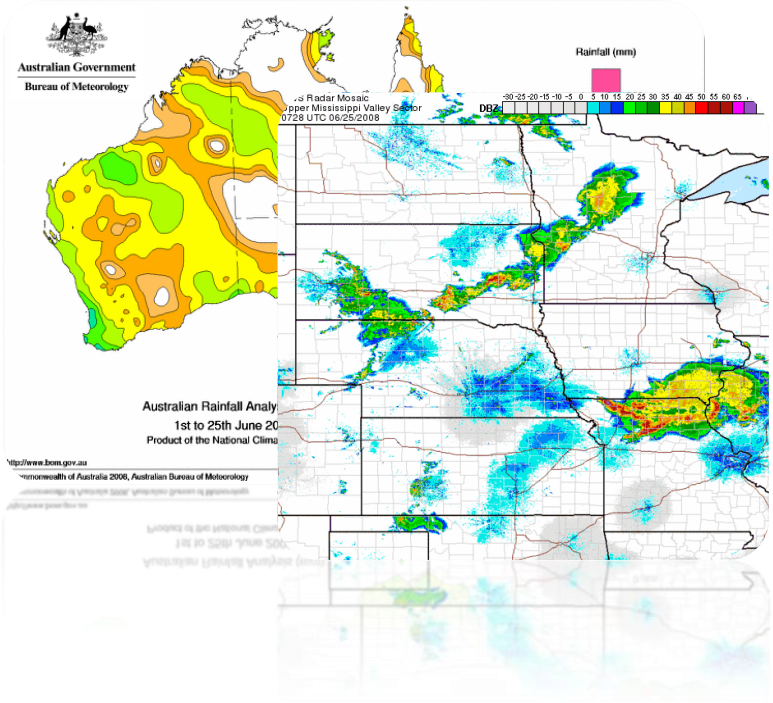
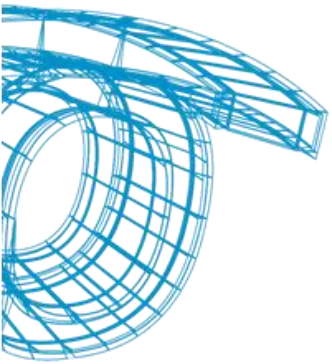
Motivation

- Radar data representation for meteorological analysis.



- 2D → 3D/4D
- Confusing
- Not accessible to inexperienced people

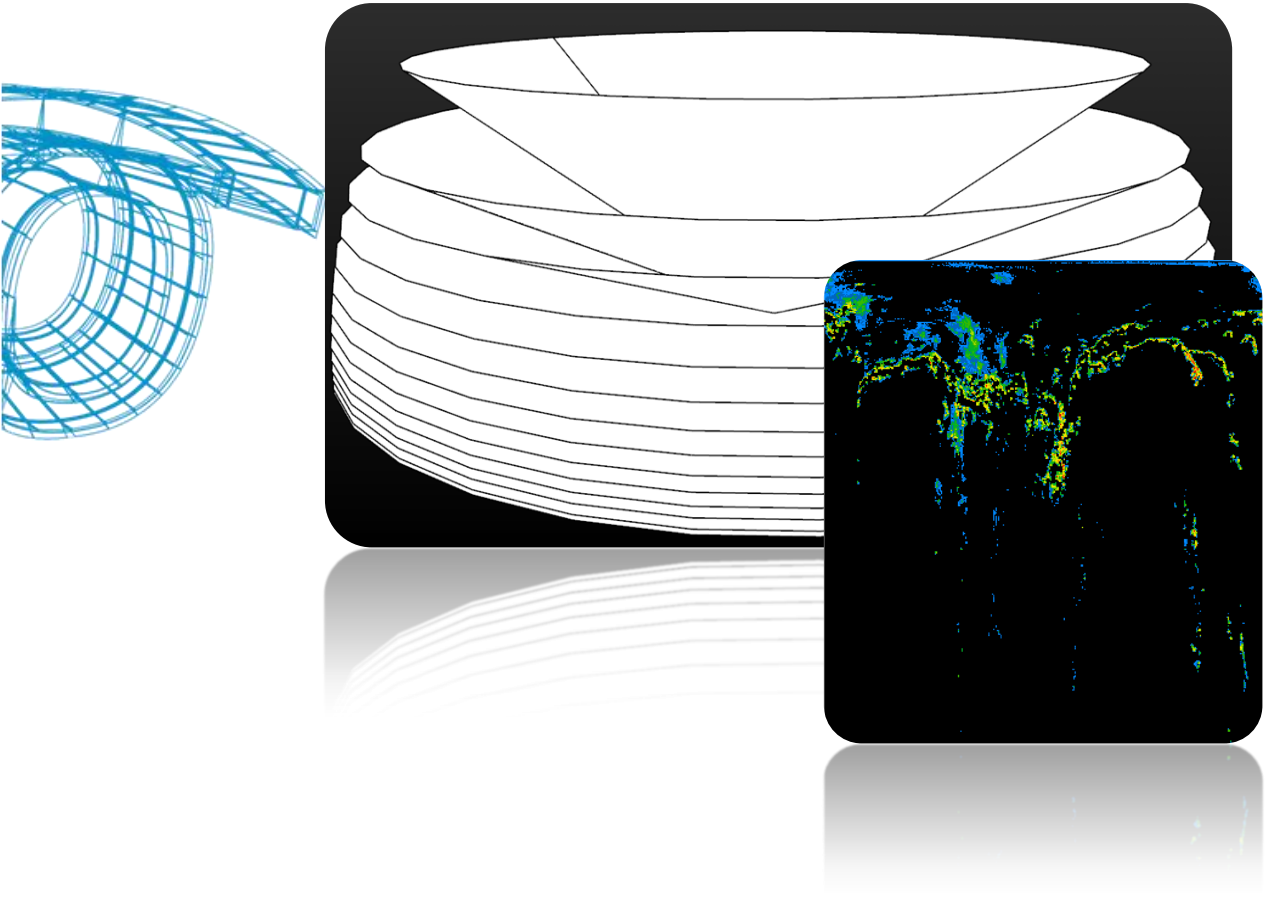
Objectives



- Represent the weather data with a interactive and immersive hybrid 3D viewer through a stereoscopic representation.
- Easy interaction between user and the represented scene using a gesture interface.

Representation and 3D visualization

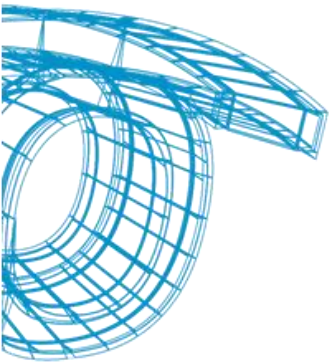
- Doppler radar data representation

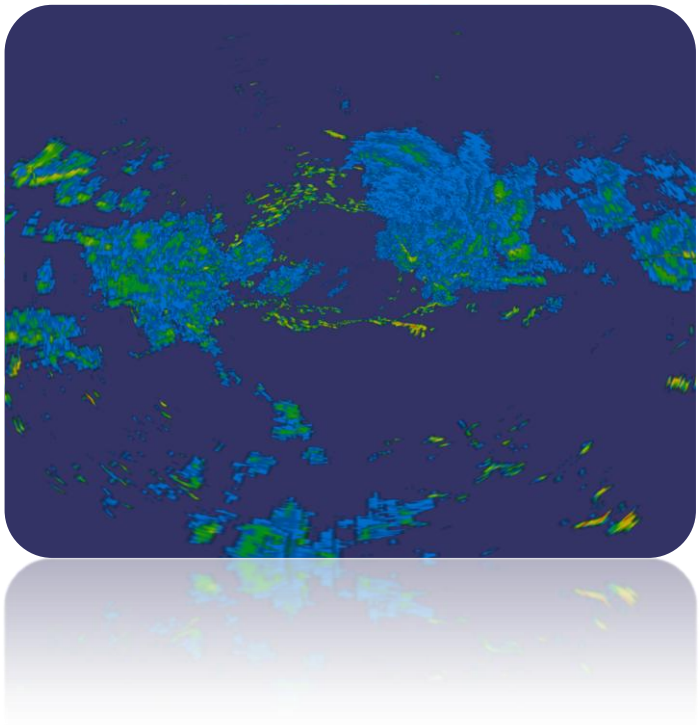


- Conical scans
- Generate cone model
- Convert data in textures
- Apply colour mask

Representation and 3D visualization

- Combination of Model Weather and 3D Model Terrain

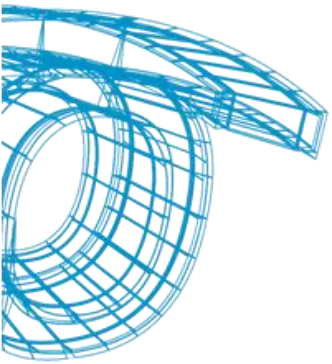


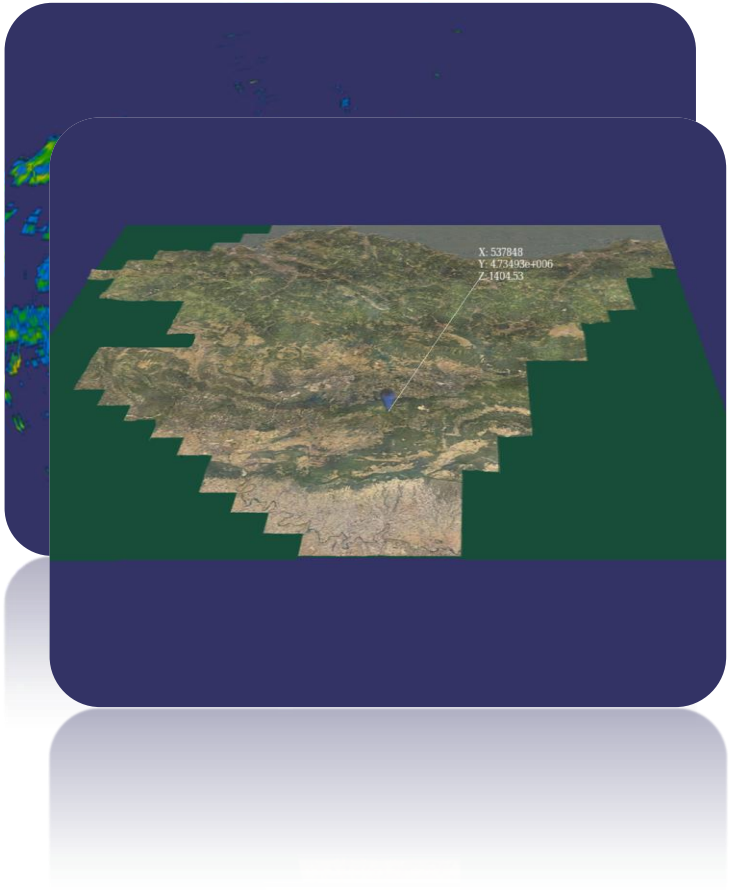


- 3D coloured data model
- 3D terrain model

Representation and 3D visualization

- Combination of Model Weather and 3D Model Terrain

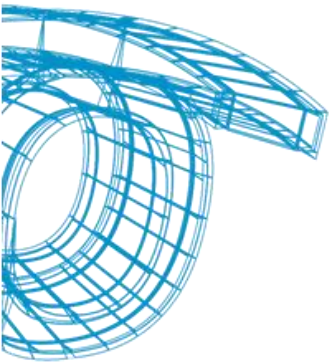


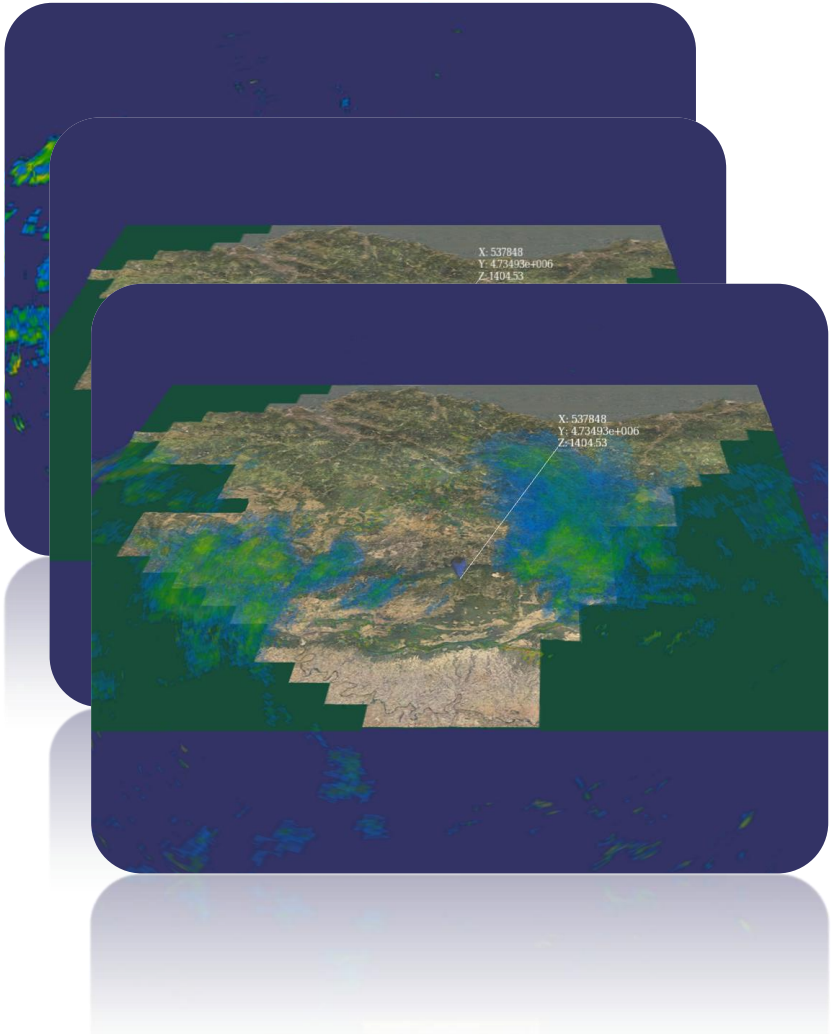


- 3D coloured data model
- 3D terrain model

Representation and 3D visualization

- Combination of Model Weather and 3D Model Terrain

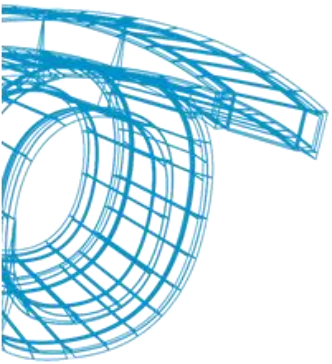


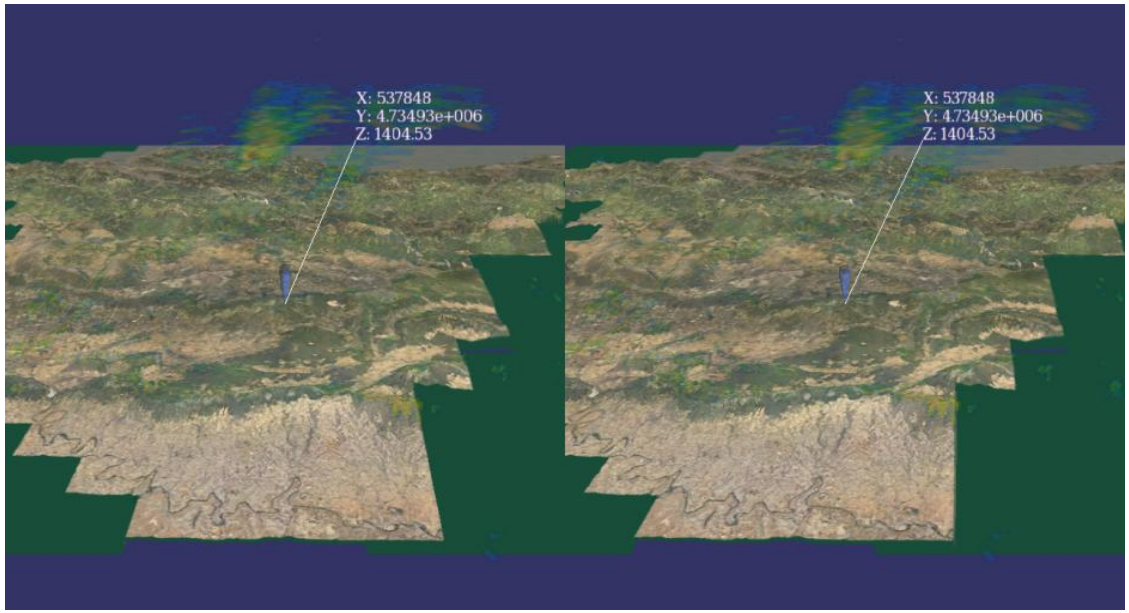


- 3D coloured data model
- 3D terrain model

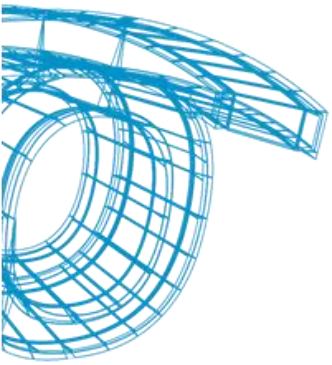
Representation and 3D visualization

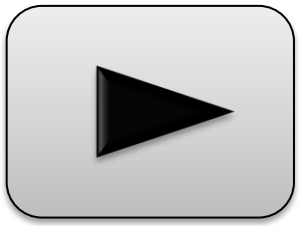
- Stereoscopic representation
- Virtual perspective adapted to the users position





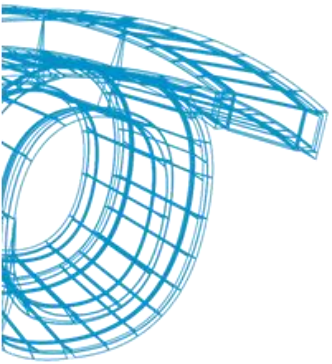
Representation and 3D visualization

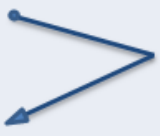




Gesture Interaction

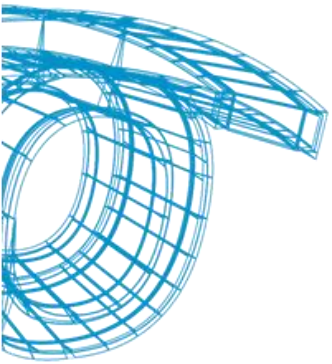
- Animation actions
  - 7 gestures defined

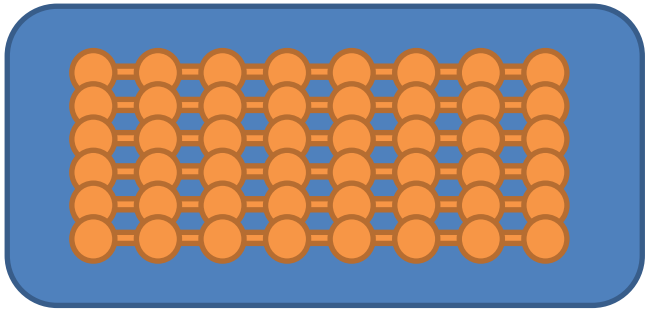


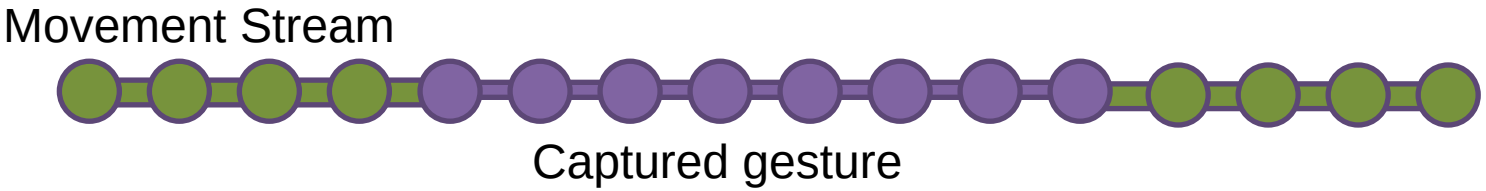
						
Next(>|)	Previous(|<)	Rew(<<)	FF(>>)	Play(>)	Stop(||)	Restart(|<<)

Gesture Interaction

- Algorithm presented for Mena et al. [11], adapted to different users and gesture styles.
- To classify the captured movements, it is compared with each gesture stored in the database.

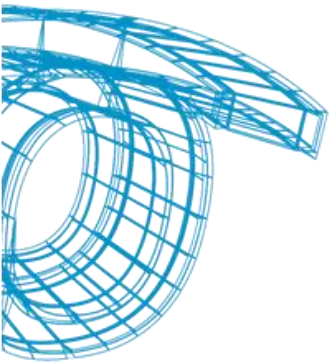






Gesture Interaction

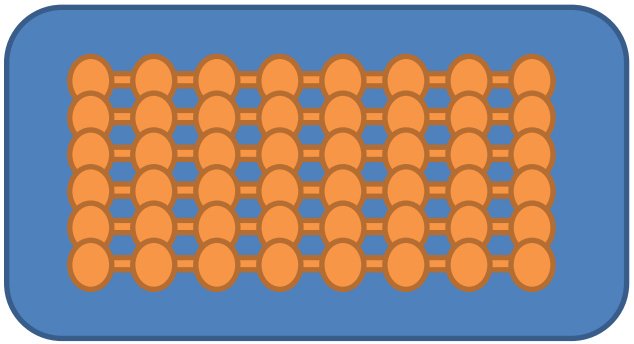
- Database is composed for N performances of each gesture.
- All of the samples are resized using Cubic Spline before store them.
- In classification, the captured data is resized too.



$$\frac{\partial f_j^{(t-(n-1))}}{\partial t} = f_j^{(t-(n-2))} - f_j^{(t-(n-1))}$$

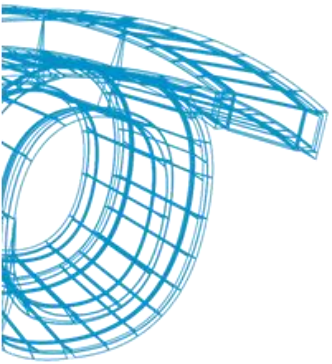
$$\frac{\partial f_j^{(t)}}{\partial t} = f_j^{(t)} - f_j^{(t-1)}$$

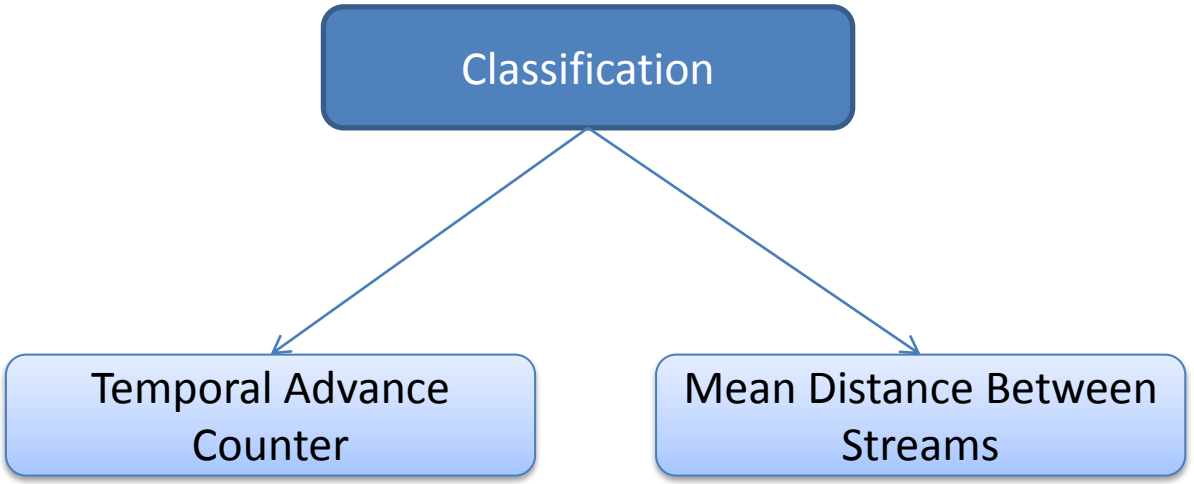
Samples database



Gesture Interaction (How to classify)

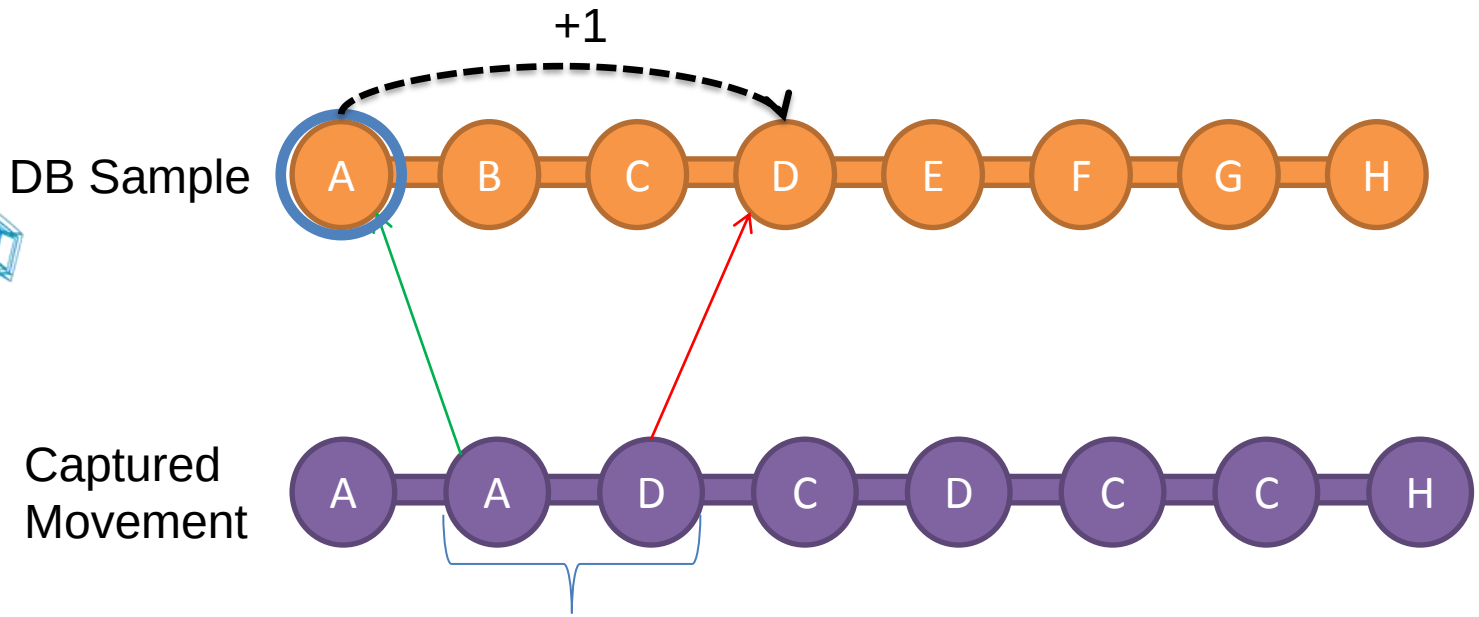
- It uses two values for classification:
  - A temporal advance between captured and database samples
  - The Euclidean distance between both captured and database samples





Gesture Interaction

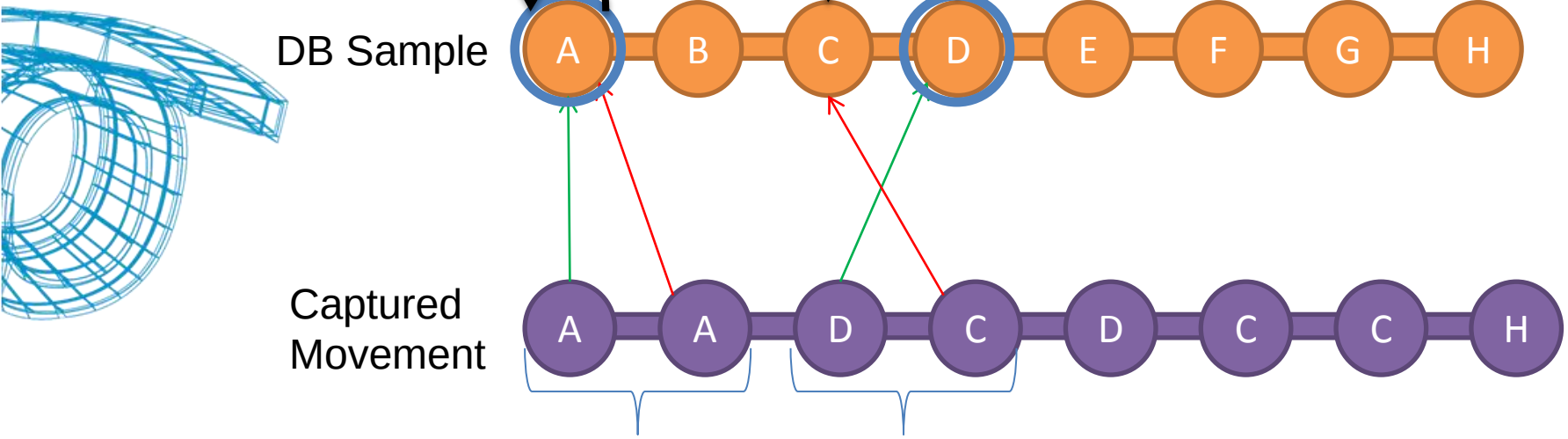
- Temporal Advance Calculation



Previous Nearest
Current Nearest

Gesture Interaction

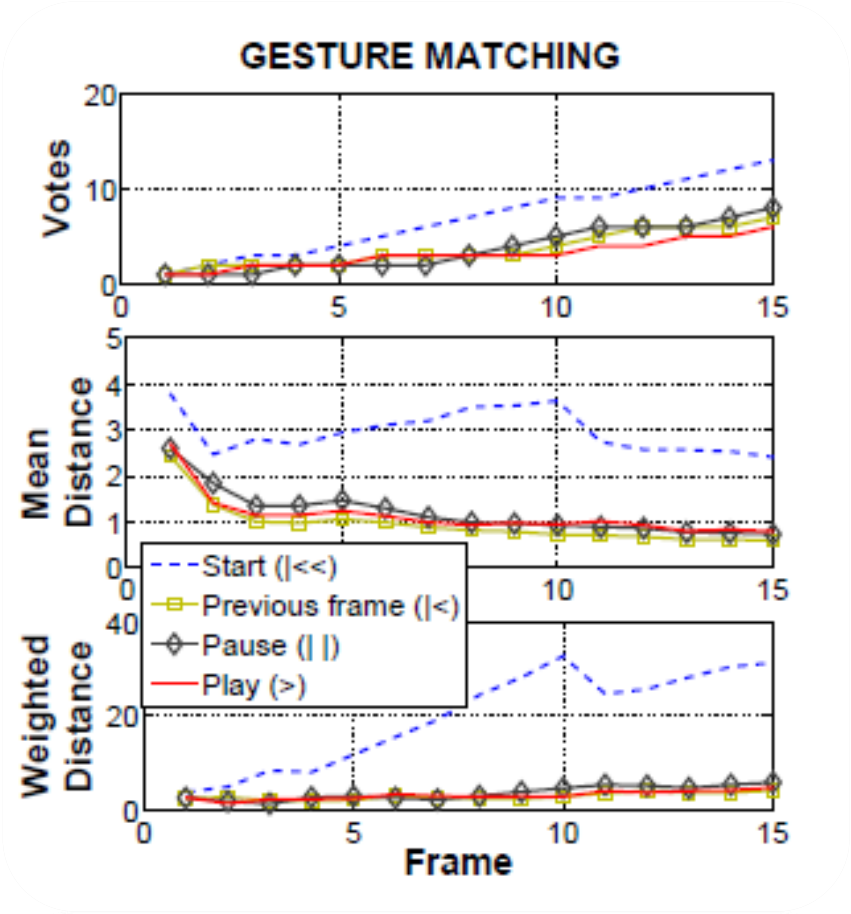
- Temporal Advance Calculation



Previous Nearest
Current Nearest

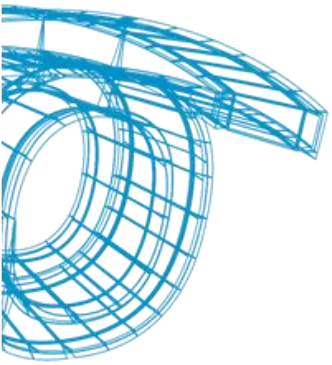
Gesture Interaction

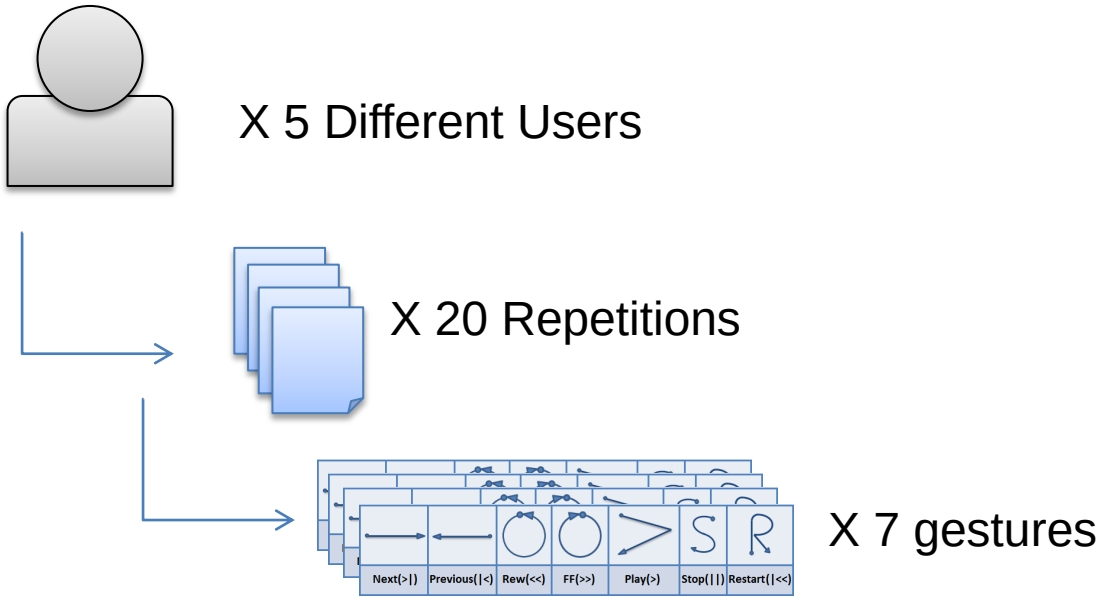
- Graphical matching representation



Experimental Results

- Captured data (training gestures)

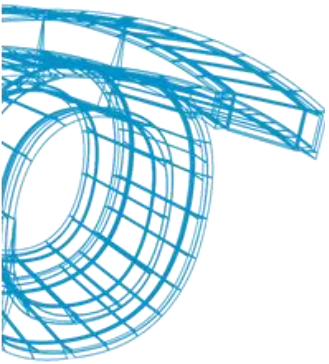


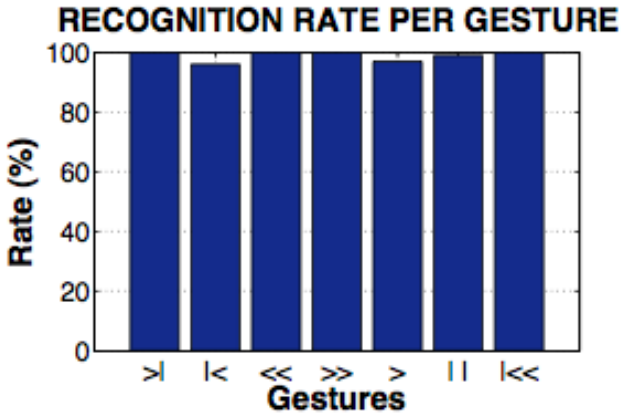


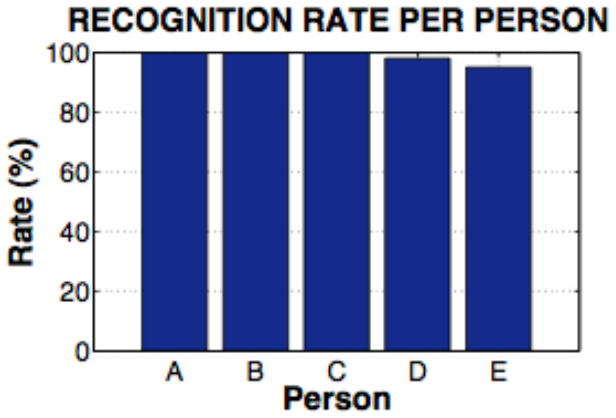
Total: 700 Gestures

Experimental Results

- Leave one out and test results



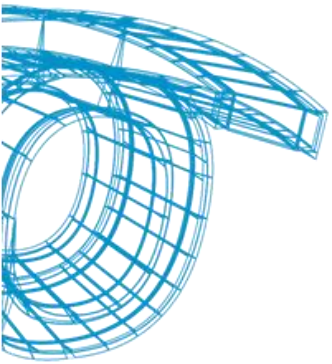




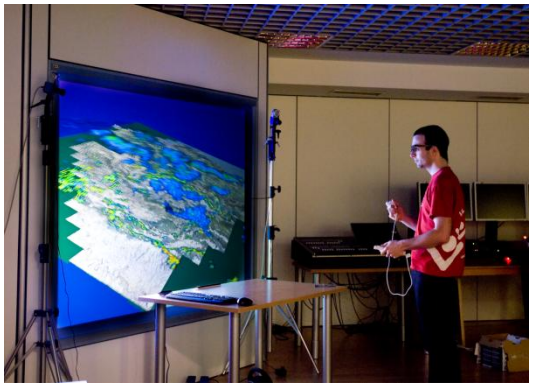
> 96%

> 95%

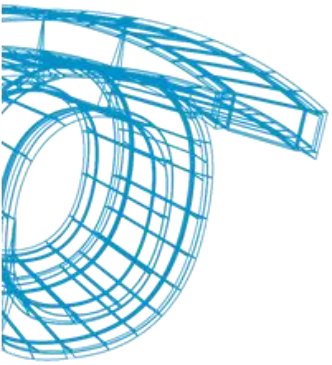
Conclusion



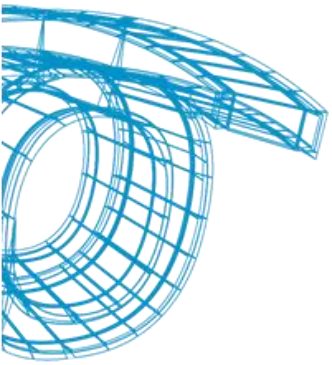
- Interactive and stereoscopic hybrid 3D viewer for Doppler radar data
- Stereoscopic immersive representation
  - Polarised retro-projected 3D representation
  - User position adapted perspective
- Gesture interface using accelerometer data



Future Work



- Automatic segmentation
- More instruments added to the representation
- Filtering and noise reduction



Thanks for your attention

Questions?