OBJECTIVES

- Develop a framework for on-line 3D modeling useful for human computer interaction (HCI) or telepresence applications
- Propose an adaptation of the Crust algorithm for incremental reconstruction
- Fuse new data into the reconstructed model based on measure uncertainty and novelty
- Virtual view synthesis through body motion estimation and hybrid sensor composed by a video and depth camera

CHALLENGES AND APPROACHES

- Realistically represent the user’s body appearance
- Enhance the presence feeling and immersion in netmeeting or interaction scenarios
- Combine body motions estimation to a depth camera to address the video reconstruction problem on object’s low-texture regions
- Treat deformable bodies as a set of rigid transformations

MESH MODELING

- A new and incremental version of the Crust algorithm is proposed to add a new set of sample points \( X_{t+1} \) to the surface mesh, without a full recalculation:

Algorithm 1 Crust incremental algorithm

1: \( P_{t+1} = \) poles of \( X_{t+1} \)
2: \( P_{t+1} \cup X_{t+1} \) as new Delaunay triangulation vertices
3: Extract triangles whose vertices belong to \( X_t \cup X_{t+1} \)

- Mesh model using Crust triangulation

REAL-TIME 3D RECONSTRUCTION SYSTEM

COMBINES VISUAL FEATURES AND SHAPE-BASED ALIGNMENT

Scan \( \rightarrow \) Registration \( \rightarrow \) Integration \( \rightarrow \) Mapping

- **Scan**
  - Multiview Scan: one single RGB-D sensor (kinect)
  - Correspondence: RGB-D sensor provides simultaneously scene 3D information and respective 2D image, SURF establishes the 2D match
  - Registration: 3D point clouds alignment, two corresponding 3D points sets, \( \{x_t^i\} \) and \( \{x_t^{i+1}\} \), \( i=1:N \)

\[
\varepsilon^2 = \sum_{i=1}^{N} \left\| x_t^{i+1} - Rx_t^i + t + v_i \right\|^2
\]

- **Integration**
  - Information relevance based on the uncertainty of range sensor. Confidence inversely proportional to the distance \( L \) and angle \( \Theta \) of data acquisition: \( C = \frac{1}{L\Theta} \)

CONCLUSIONS

- A framework for on-line incremental 3D modeling useful for HCI
- Virtual view synthesis through motion body estimation & RGB-D sensor
- A new incremental version of Crust algorithm that efficiently adds new vertices to an already existing surface without full mesh recalculation
- Integration of 3D data based on confidence measures avoiding redundant information computation.