

**DELOS**

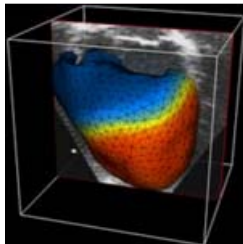
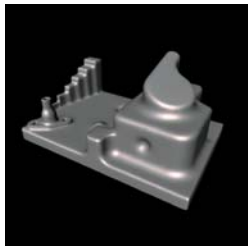
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# **Description, Matching and Retrieval by Content of 3D Objects**

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## 3D object databases

- Next future applications of content-based retrieval will consider also databases of 3D objects. Key research subjects for databases of 3D objects.
  - Solutions for acquisition and reconstruction of 3D object
  - Descriptors of 3D shape and apparent visual features
  - Similarity search: “Global similarity” content-based search but presumably more important “local similarity” content-based search

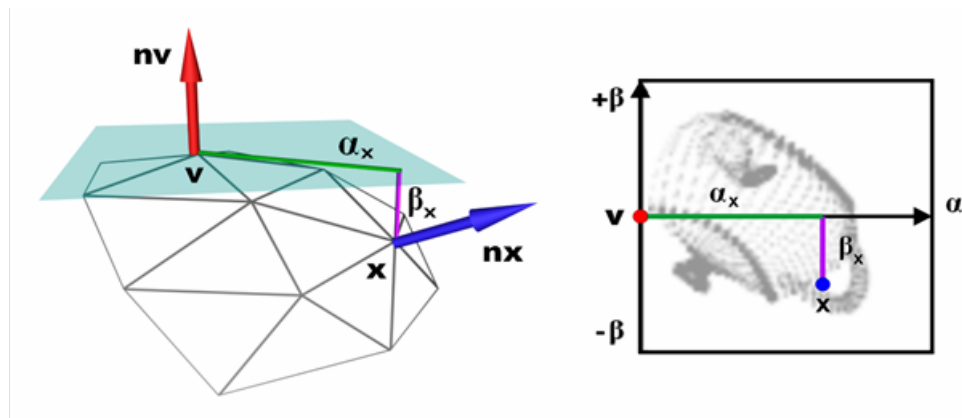


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- Subject of the task research:  
content-based retrieval of 3D objects by local and global similarity
- Subject of the demo:  
content-based retrieval of 3D objects using *spin image* signature descriptors

## Spin images

- Spin images are 2D representations of 3D objects that maintain some properties of the vertices of the mesh. One vertex of the mesh is used as a reference. Positions of the other vertices are calculated as viewed from the reference vertex.

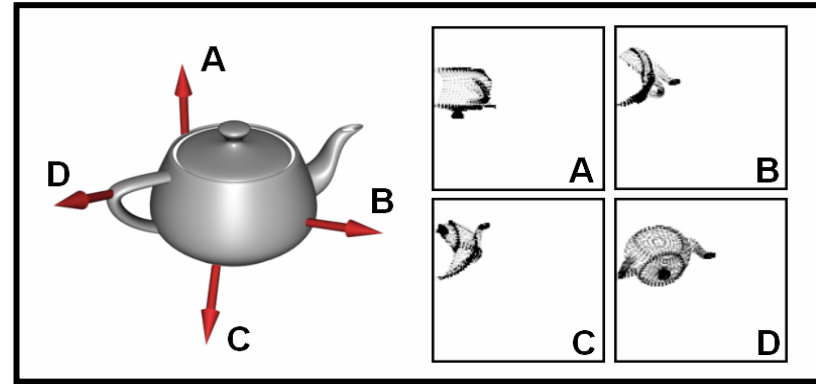


For each vertex,  $V$  identifies the plane normal to  $NV$ ,  
 $\alpha$   $\beta$  are the coordinates of the projection of a mesh  
vertex on this plane

# Spin image signatures

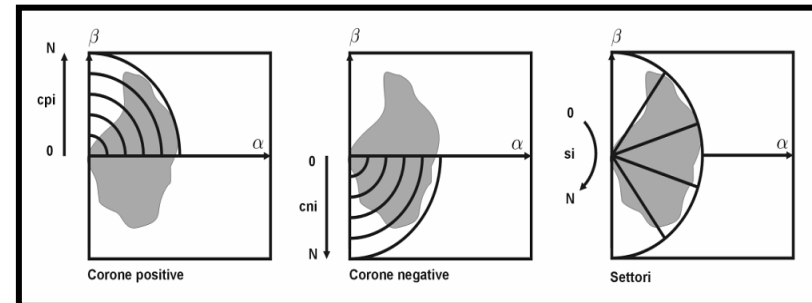
- Several spin images are needed to have a complete description of a 3D shape.

Spin images use an object-centered coordinate system therefore they are invariant to rigid transformations, and have limited sensibility to variations of position of mesh vertices.

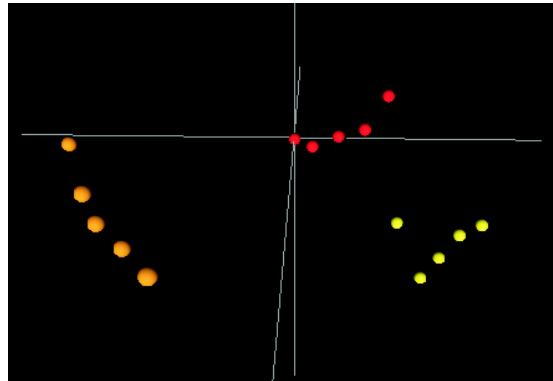
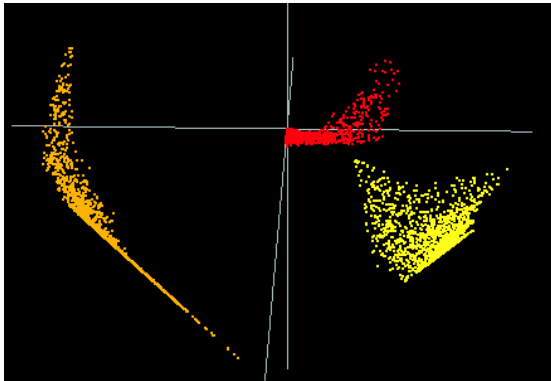


- For the purpose of content-based retrieval, we need to identify a small number of spin images that are sufficient to provide a complete description of the properties of the 3D shape. A spin image is mapped into a vector descriptor that captures its salient properties.

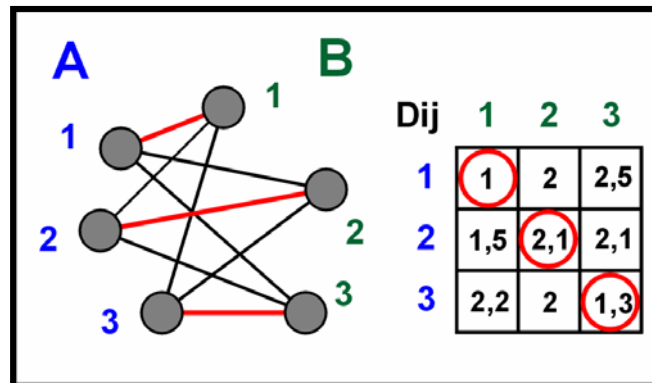
A spin image descriptor is a 18-dimensional feature vector, each element containing the fraction of the spin image area that is included within a circular section or a sector



- Spin image descriptors are clustered using *fuzzy-c-means* so that a small number of spin image descriptors are obtained for each 3D object.



- Given two 3D object models, similarity can be checked considering the distances between the centers of the corresponding spin image clusters.



$$D_{ij} = \sum_k |C_{i_k} - C_{j_k}|$$

$$M_d(A, B) = \sum D_{coppie}$$

## Example of retrieval

