ED5340 - Data Science: Theory and Practise

L29 - Deep Networks in Practise

Ramanathan Muthuganapathy (https://ed.iitm.ac.in/~raman)
Course web page: https://ed.iitm.ac.in/~raman/datascience.html
Moodle page: Available at https://courses.iitm.ac.in/

Fields / Topics that employ DL

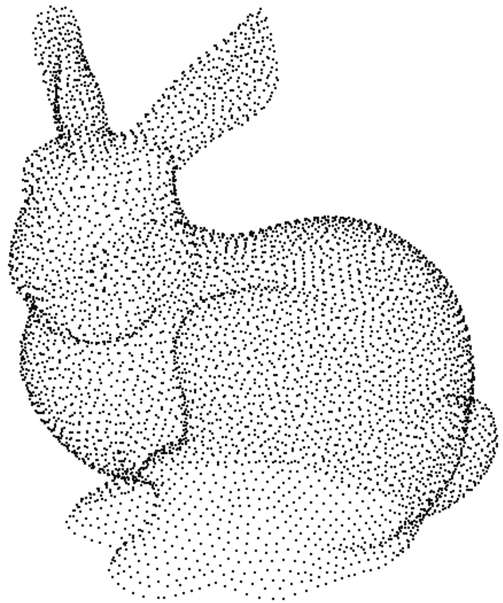
- Computer Vision (Major one but not the only one)
    - Image data as the input
        - Object recognition / Classification / Search & Retrieval
        - Segmentation / Decomposition
- 3D Models - Graphics / CAD
    - Point cloud or Mesh model
        - Classification / Search & Retrieval
        - Segmentation / Decomposition
        - Reconstruction
        - Feature recognition (typically, mechanical model features)

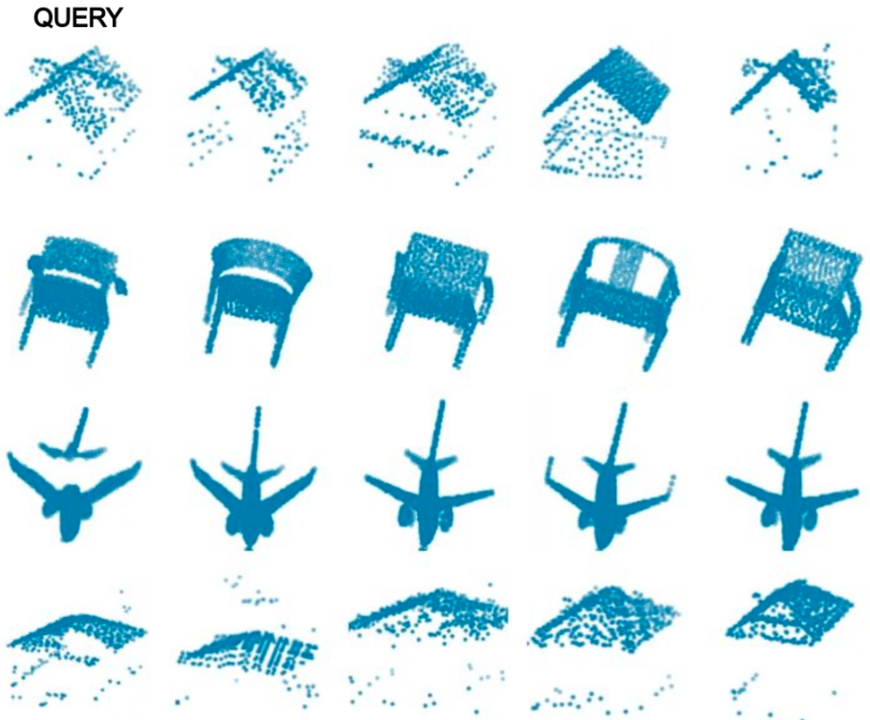
Fields / Topics that employ DL

- Sketch-based modelling
    - Input are sketches (images!)
        - Classification / Search & Retrieval
        - Sketch clean-up
- Analysis
    - Inputs - Points / Images
        - Prediction (Such as stresses / strains)
        - Interpretation of data
        - Flow Analysis (CFD)
- Speech / NLP / Signal processing / Medical Imaging

Point cloud

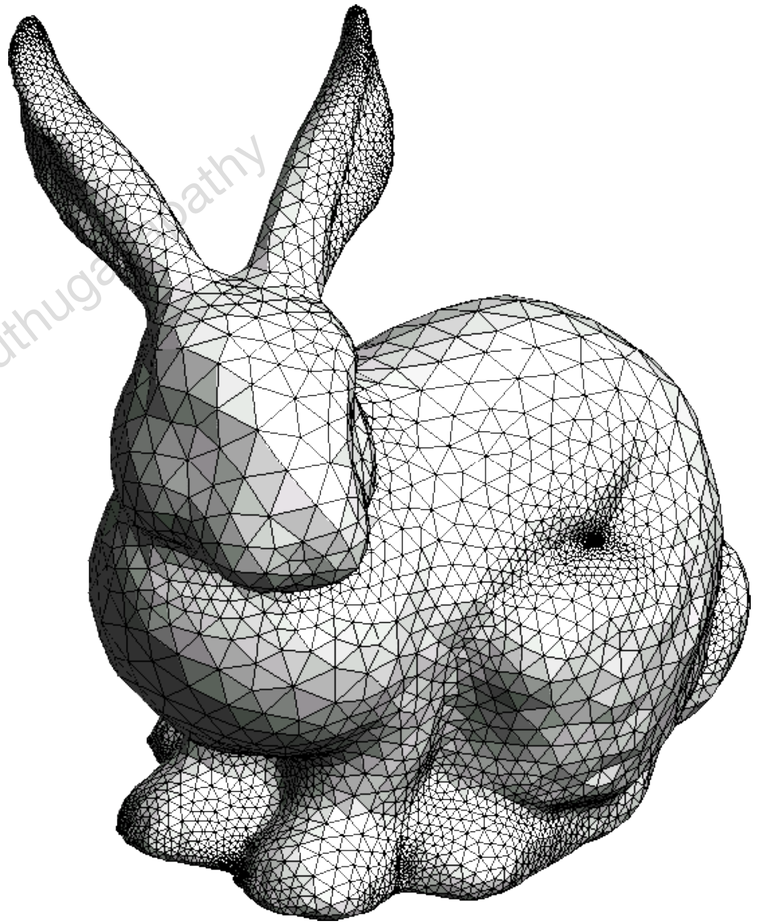
- A 3D model represented only as a set of points
- No predetermined order (Unordered cloud of points)



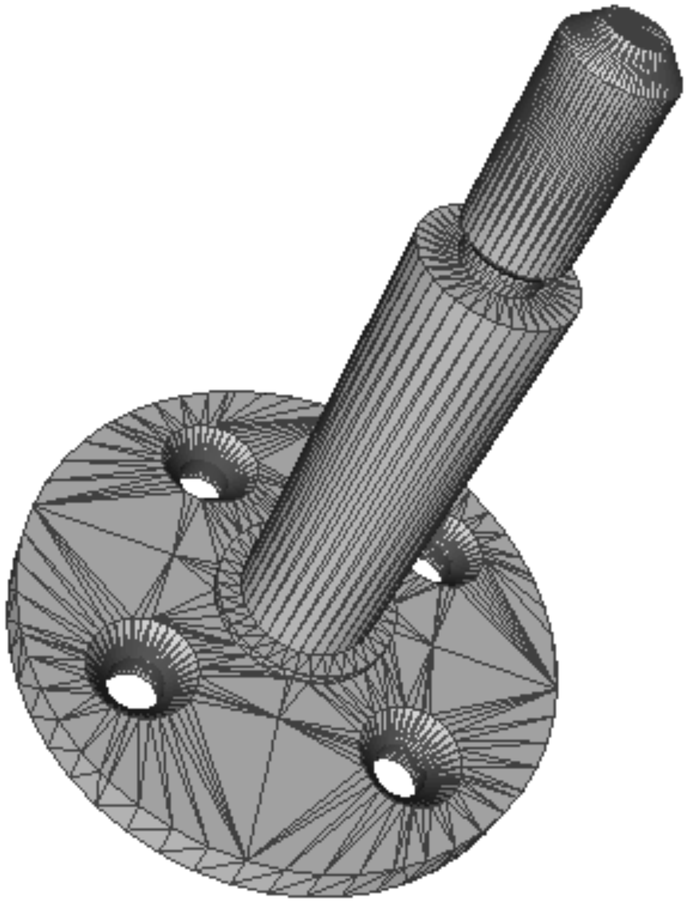


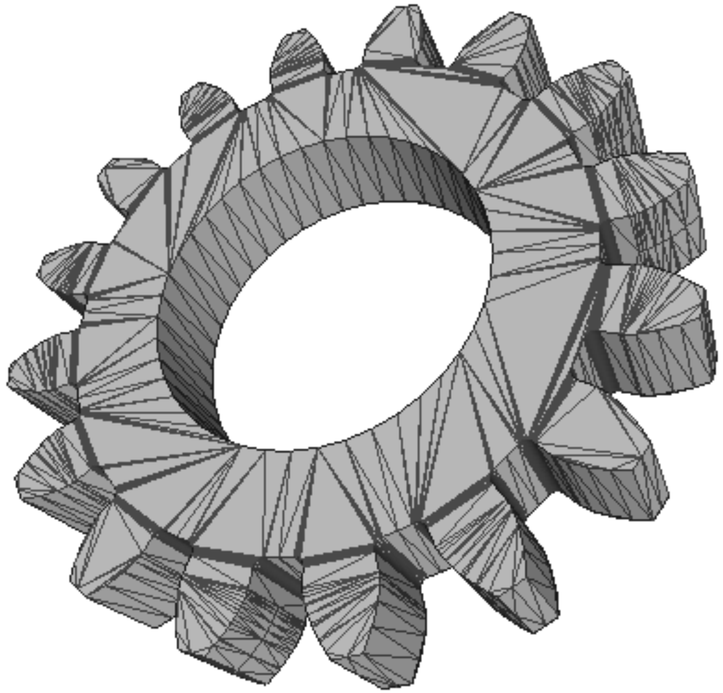
Mesh model

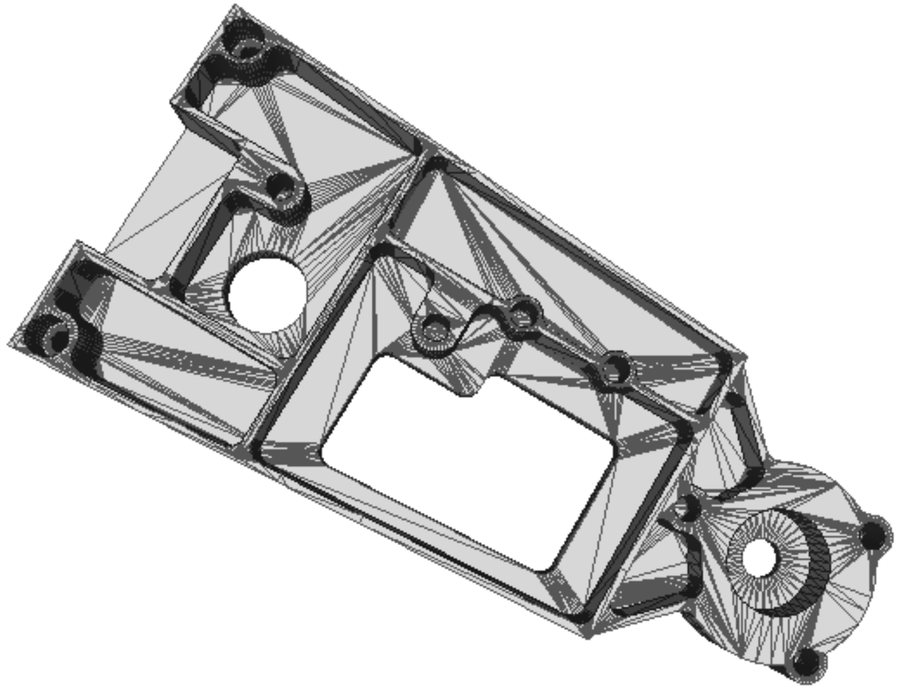
- Also called as tessellated models
- Triangulated data (Input file will consist of only vertices of triangles)
- No topology / geometry information



Mesh model

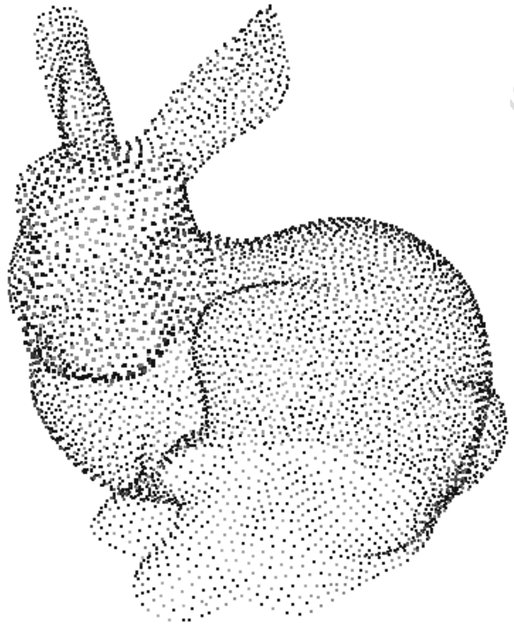


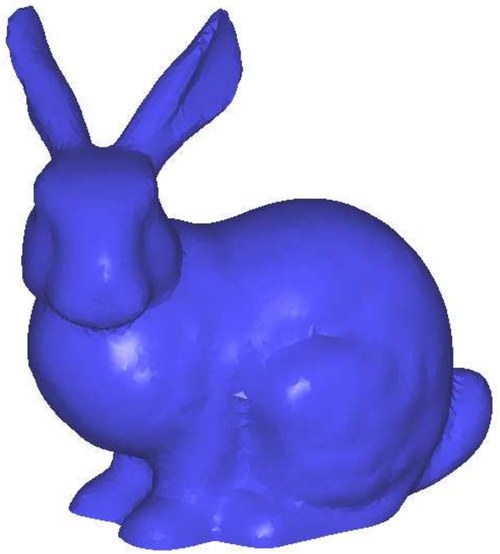




Reconstruction

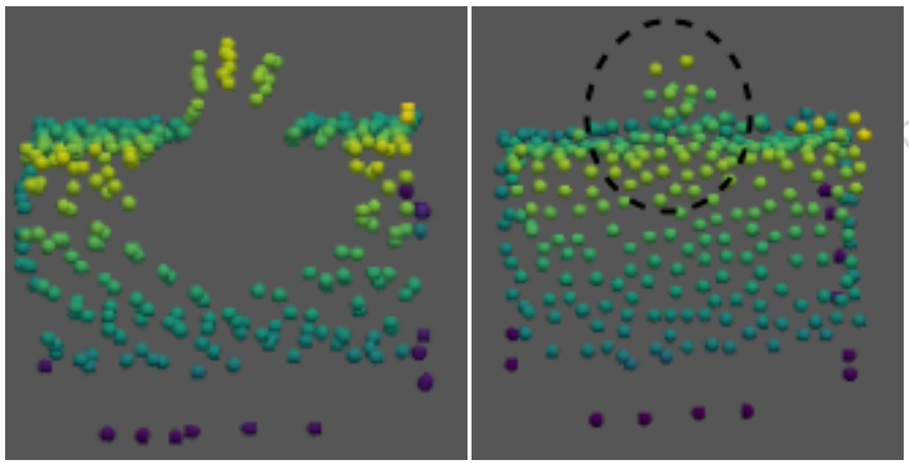
- Input is the point cloud
- Output is the mesh model





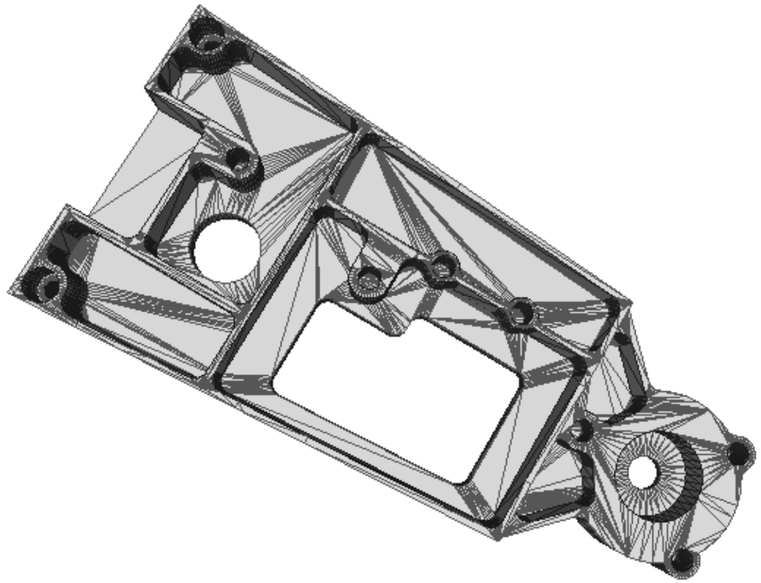
Point / shape completion

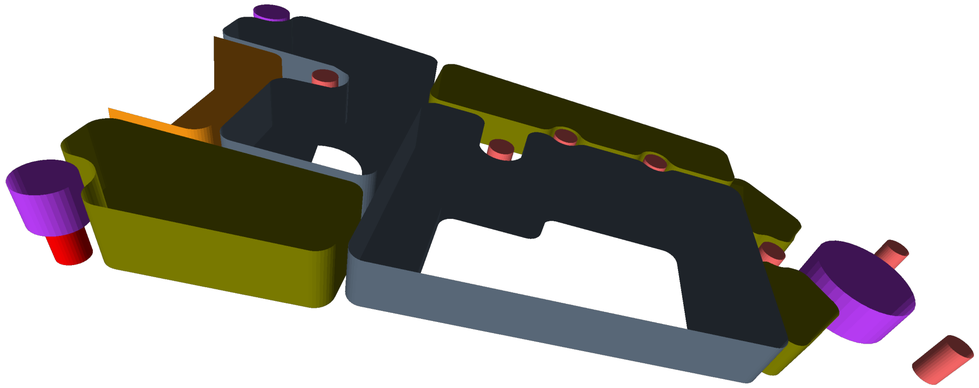
- Input - Incomplete point cloud (missing data)
- Output - Completed point cloud



Feature identification

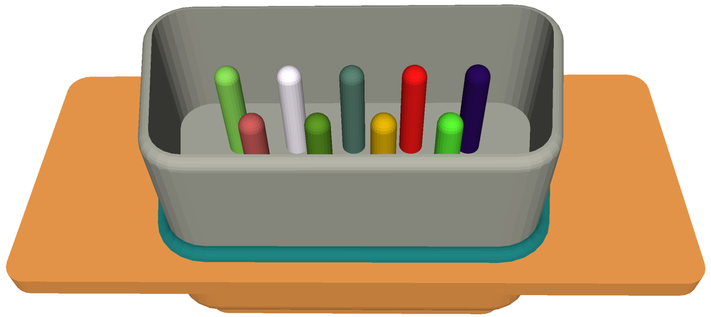
- Input - Mesh model
- Output - Identify features like holes / slots etc.

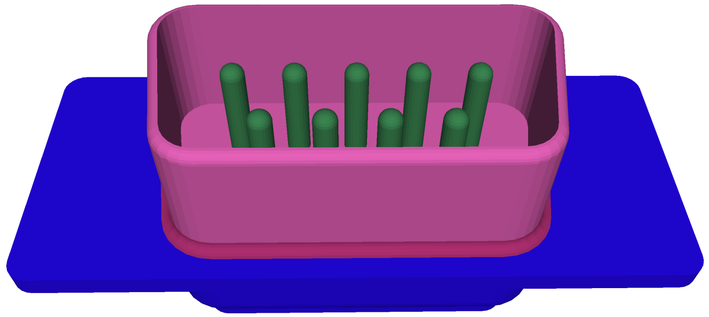




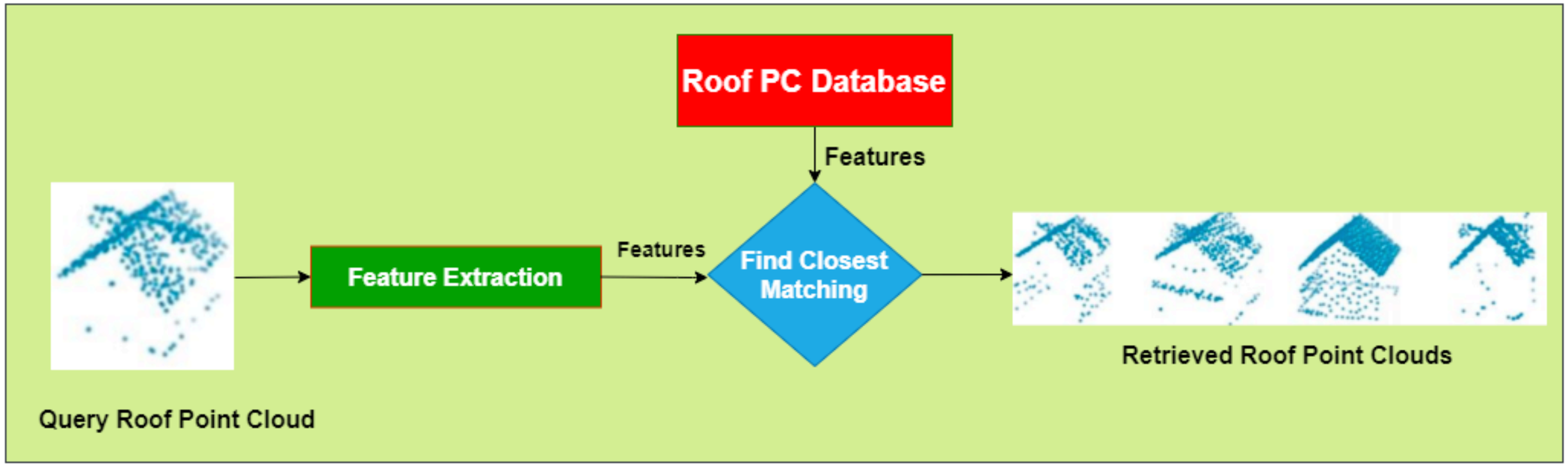
Feature identification

- Input - Mesh model
- Output - Group / Cluster similar parts



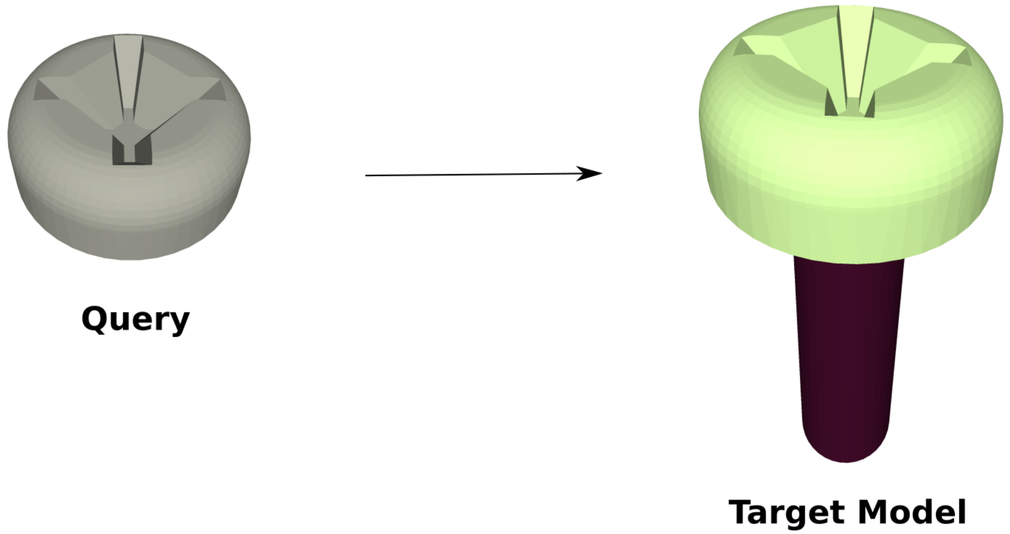


Point cloud retrieval (roof)



Partial search

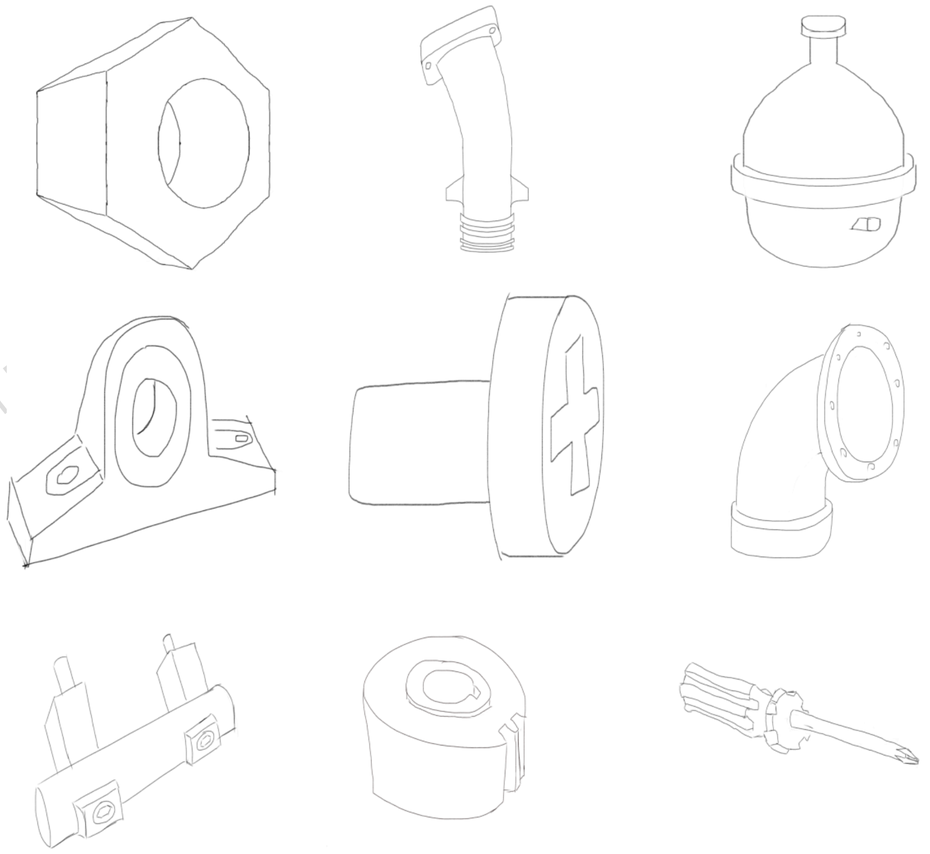
- Input - part of a model
- Output - Similar models consisting the input as a part(s)



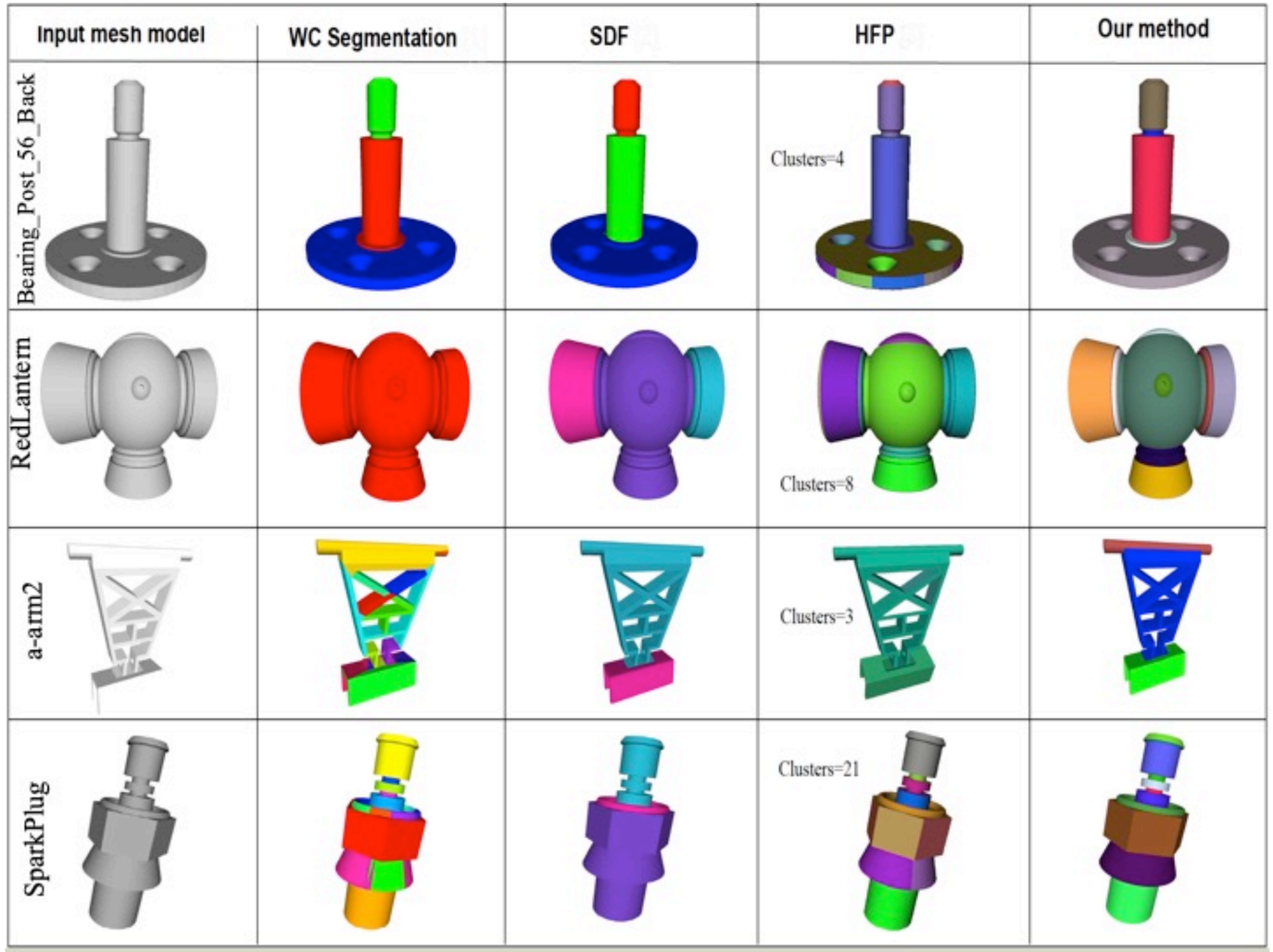
Sketch processing

hand drawn sketches

- Input - Sketch of a 3D model
- Output - Similar 3D models.
- Sketch completion / sketch clean up is also another interesting problem



Segmentation

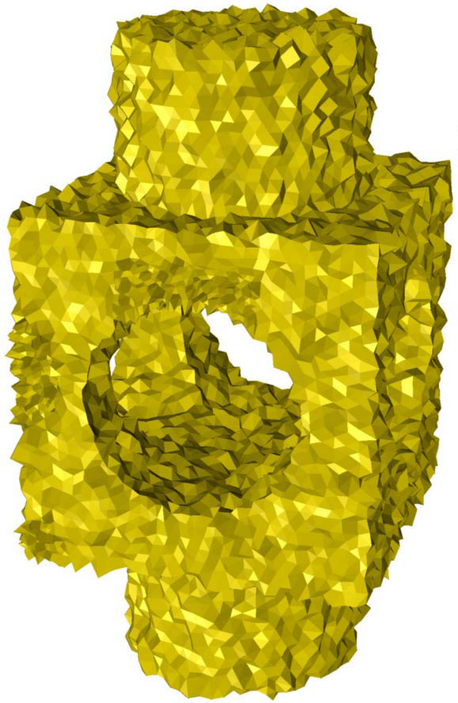


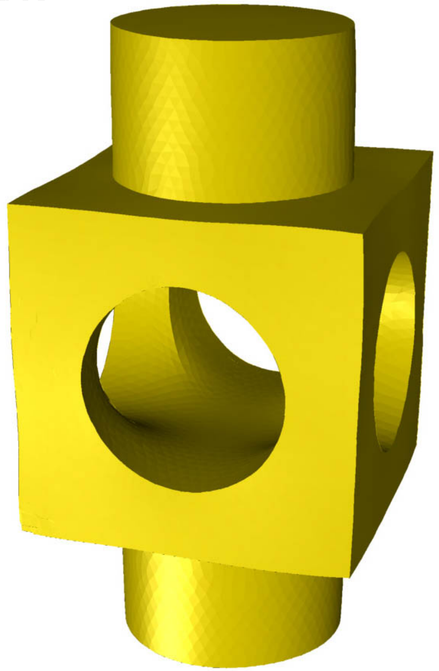
Point set segmentation

- Input - Point cloud
- Output - classify the points belonging to a particular segment.

Reconstructing a noisy model

- Input - model with noise
- Output - Reconstructed model after removing noise





DL-based Analysis of Loading conditions

- FEA (Finite element analysis) is a popular.
- DL-based approach towards analysis.