MeshLab

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MeshLab

- Last version
 - <u>http://www.meshlab.net/</u>
 - <u>https://github.com/cnr-isti-vclab/meshlab/releases</u>
- Video Tutorial
 - <u>https://www.youtube.com/user/MrPMeshLabTutoria</u>
 <u>ls</u>

MeshLab

<u>MeshLab doesn't have a undo.</u> <u>Please save your project frequently</u> <u>otherwise if MeshLab crashes or if</u> <u>you apply wrongly a filter that</u> <u>modifies your mesh you lose all your</u> <u>works.</u>

MeshLab – Mesh Data

- Per-vertex attribute
 - Position
 - Normal
 - Color (VN)
 - Quality (VQ)
 - Texture Coordinate (VT)
 - Vertex Radius (VR)
 - Curvature value (VK)
 - Curvature direction (VD)

MeshLab – Mesh Data

- Per-face attribute
 - Vertex reference
 - Normal
 - Color (FC)
 - Quality (VQ)

MeshLab – Mesh Data

- Wedge To assign a different attribute to the vertex depending on the face
 - Color (WC)
 - Texture Coordinate (WT)
 - Normal (WN)



Trackball

- Paradigm: Object in-hand
- Help \rightarrow On screen quick help

Quick Help	
3D Wi	indow
Drag:	Rotate
Ctrl-Drag:	Pan
Shift-Drag:	Zoom
Wheel:	Zoom
Alt-Drag:	Z-Panning
Ctrl-Shift-Drag:	Change light direction
Shift-Wheel:	Change perspective (up to a orthographic camera)
Ctrl-Wheel:	Move near clipping plane
	(in image space: 0 is viewer position, 1 is trackball center)
Double Click:	Center on mouse
Alt+enter:	Enter/Exit fullscreen mode
Ctrl-Shift H:	Reset Trackball

Edit Tools

Interactive tools

- Click on the tool icon to enter
- Click again to the icon to exit
- Click on the trackball icon to temporarily suspend from the edit mode, or press ESC
- Click again to the trackball icon to reactive the edit mode, or press ESC



Layers



Layer icons dialog

- Load different mesh on several layer
- Manage the layer visibility and rendering
- Help \rightarrow On screen quick help

Layer Window

Click on eye icon: Toggle visibility status of the layer Ctrl-Click on eye icon: Make Invisibile all other layers Alt-Click on eye icon: Make Visibile all other layers Shift-Click on eye icon: Invert visibility status of all the layers

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Rendering Modes

- Visualization of different data globally and for each single layer
 - Bounding box
 - Point
 - Edge 🕅
 - Triangle
 - Selection data
 - Edge decorators



Decorator

- Visualization of additional information
 - Normal
 - Camera position
 - Quality information
 - Axis
 - Bounding box

Advanced Shading

• Render \rightarrow Shader \rightarrow xray

MeshLab 2016.12 - [Project_2]

Sile Edit Filters Render View Windows Tools Help D 🖆 🖻 🗞 🧇 🖻 🌒 🗊 🗊 🔟 📜 🖤 🚸 🗇 🗛 🗖 📙 🖸 🖉 🌺 🤽 🍕 🍕 🚺 💥 🛪 🛠 FOV: 60 FPS: 84.7 BO_RENDERING

Advanced Shading

• Render \rightarrow Shader \rightarrow Radiance Scaling



Selection

- Interactive tool to select
 - Point
 - Triangles
 - Connected Component ^{*}



- Keep pressed CTRL to add to the current selection
- Keep pressed SHIFT to remove from the current selection
- Keep pressed ALT to select only visible elements

Selection

- Automatic filter (Filter->Selection)
 - Dilate
 - Erosion
 - Invert, None, All
 - Border
 - By view angle
 - By quality

Delete Selection

- Delete the current selection
 - Only selected points and the incident faces



- Only the selected faces but no the unreferenced vertices
- The selected faces and the referenced vertices by the selected faces

Snapshot

- Save the current rendering as png image
- Save high resolution images using tiling

Save snapshot	?	×
Output folder .		
Base name snapshot Counter 0 🖨 🗌 Snap All Layers	🗌 Tile	d Save
Background MeshLab Gradient 🔻 Screen Multiplier 1 🖨 🗌 Add Snapshot as ne	ew Raster	r Layer
Cancel	Sav	/e









Smoothing

- Filter \rightarrow Smoothing,Fairing,Deformation \rightarrow
 - Laplacian smooth
 - Scale dependent laplacian smooth
 - Taubin smooth
 - Laplacian smooth (surface preserve)

Alignment Tools

- Glue the first mesh
- For each other mesh, use Point Based Glueing to find the rough alignment
- Launch Process

•



Alignment Tools

Point based Glueing

- Select by double click the correspondences, the order is important
- Keep pressed CTRL to remove a point



Alignment Tools

Launch Process

• Adjust the parameters (Edit Default ICP Parameters)

Default Alignment Parameters ? ×				
Sample Number	2000			
Minimal Starting Distance	10			
Target Distance	0.0005			
Max Iteration Num	100			
Normal Equalized Sampling				
MSD Reduce Factor	0.8			
Sample Cut High	0.75			
Rigid matching				
Reset OK	Cancel	Help		

Alignment with scale

- Measure a common feature between the mesh
- Compute the scale and apply the scale Filter \rightarrow Normal,Curvature, Orientation \rightarrow Transform:Scale, Normalize (uniform scale)
- Run the alignment procedure with no-rigid-option



3D Reconstruction

 Weighted average of perscan distance field
 Filter →
 Remeshing,Simplification,
 Reconstruction →
 Surface

reconstruction:VCG

Surface Reconstruction: VCG

The surface reconstrction algorithm that have been used for a long time inside the ISTI-Visual Computer Lab. It is mostly a variant of the Curless et al. e.g. a volumetric approach with some original weighting schemes, a different expansion rule, and another approach to hole filling through volume dilation/ relaxations.

The filter is applied to **ALL** the visible layers. In practice all the meshes/point clouds that are currently visible are used to build the volumetric distance field.

Voxel Side (abs and %)	world unit 2.5028	perc on(0 2	5 <i>0.281)</i> 00 🌲	VoxelSide
SubVol Splitting	1			The level of recursive splitting of the subvolume reconstruction process. A value of '3' means that a 3x3x3 regular space subdivision is created and the reconstruction process generate 8 matching meshes. It is useful for reconstruction objects at a very high resolution. Default value (1) means no splitting.
Geodesic Weighting	2			The influence of each range map is weighted with its geodesic distance from the borders. In this way when two (or more) range maps overlaps their contribution blends smoothly hiding possible misalignments.
Show Result				if not checked the result is only saved into the current directory
Volume Laplacian iter	1			How many volume smoothing step are performed to clean out the eventually noisy borders
Widening	3			How many voxel the field is expanded. Larger this value more holes will be filled
Vertex Splatting				This option use a different way to build up the volume, instead of using rasterization of the triangular face it splat the vertices into the grids. It works under the assumption that you have at least one sample for each voxel of your reconstructed volume.
Post Merge simplifica	ation			After the merging an automatic simplification step is performed.
PreSmooth iter	3			How many times, before converting meshes into volume, the normal of the surface are smoothed. It is useful only to get more smooth expansion in case of noisy borders.
Def	ault			Help
Clo	150			Apply

3D Reconstruction

- Screened Poisson Surface
 Reconstruction
 Filter → Remeshing,Simplification,
 Reconstruction → Screened
 Poisson Surface reconstruction
- If "Iterpolation Weight" is zero then Classical Poisson reconstruction
- "Reconstruction Depth", maximum level of the octree



This surface reconstruction algorithm creates watertight surfaces from oriented point sets. The filter uses the original code of Michael Kazhdan and Matthew Bolitho implementing the algorithm described in the following paper: Michael Kazhdan, Hugues Hoppe, "Screened Poisson surface reconstruction" ACM Trans. Graphics, 32(3), 2013

Merge all visible layers	
Reconstruction Depth	8
Minimum Number of Sample	es 1.5
Interpolation Weight	4
Confidence Flag	
Pre-Clean	
•	,
Default	Help
Close	Apply

Cleaning Poisson Reconstruction

• Filter \rightarrow Selection \rightarrow Selection by vertex quality



Cleaning and Repairing

- Filter \rightarrow Cleaning and Repairing
- Filter \rightarrow Selection

Simplification

- Filter \rightarrow Remeshing, Simplification, Reconstruction \rightarrow Simplification: Clustering Decimation
- Filter \rightarrow Remeshing, Simplification, Reconstruction \rightarrow Simplification: Quadric Edge Collapse

Simplification: Clustering Decimation					
Collapse vertices by creating a three dimensional grid enveloping the mesh and discretizes them based on the cells of this grid					
Cell Size (abs and %)	world unit perc on(0 216.751) 2.1675 1.000 aces				
Default	Help				
Close	Apply				

Simplification: Quadric Edge Collapse Decim...

Simplify a mesh using a Quadric based Edge Collapse Strategy; better than clustering but slower

Target number of faces	90415		
Percentage reduction (01)	0		
Quality threshold	0.3		
Preserve Boundary of the	mesh		
Boundary Preserving Weight	1		
Preserve Normal			
Preserve Topology			
Optimal position of simplified vertices			
Planar Simplification			
Weighted Simplification			
Post-simplification cleaning			
Simplify only selected faces			

Surface Comparison

- Hausdorff distance Measure distance between two meshes
 - Filter → Sampling→ Hausdorff Distance

Hausdorff Distance	×			
Compute the Hausdorff Distance between two meshes, sampling one of the two and finding foreach sample the closest point over the other mesh.				
Sampled Mesh	Poisson mesh 🔻			
Target Mesh	Poisson mesh(1)			
Save Samples				
Sample Vertexes				
Sample Edges				
Sample FauxEdge				
Sample Faces				
Number of samples	1444563			
Max Distance (abs and %)	world unit perc on(0 604.462)			
max bistance (abs and 70)	236.9419 🖨 39.200 🖨			
Default	Неір			
Close	Apply			

Quality Mapper

Colorize the mesh according the quality value





Camera Calibration

• Raster Layers



View mesh from the point of view of the current raster



Camera Calibration

 Filter → Camera→ Image Alignment: Mutual Information

Image alignment: Mutual Information						
Register an image on a 3D model using Mutual Information. This filter is an implementation of Corsini et al. 'Image-to- geometry registration: a mutual information method exploiting illumination-related geometric properties', 2009, <u>Get link</u>						
Rendering Mode:	Combined 🝷					
Starting shot	Current Trackball 🔻 Get Shot					
Estimate focal length						
Fine Alignment						
Max iterations	100					
Tolerance	0.1					
Expected Variance	2.0					
BackgroundWeight	BackgroundWeight 2					
Default			He	elp		
Close			Ap	ply		

Color Projection

• Render \rightarrow Raster-to-Geometry projection



Color Projection

- Per-vertex color
- Filter → Camera → Project active raster color to current mesh

Project active rasters color to current mesh ×					
Color information from all the active rasters is perspective-projected on the current mesh using basic weighting					
depth threshold	0.5				
Only on selecton					
🗸 use angle weight					
✓ use distance weight					
✓ use image borders weight					
✓ use depth discontinuities weight					
use image alpha weight					
Color for unprojected areas (#000000)					
Preview					
Default	Help				
Close Apply					

Color Projection

- Texture
- Filter \rightarrow Texture \rightarrow Parametrization + texturing from registered rasters

The mesh is parameterized and textured by creating some patches that correspond to projection of portions of surfaces onto the set of registered rasters.

		-		
Texture size	1024	Specifies the dimension of the generated texture		
Texture name	texture.png	Specifies the name of the file into which the texture image will be saved		
Color correction		If true, the final texture is corrected so as to ensure seamless transitions		
Color correction filter	1	It is the radius (in pixel) of the kernel that is used to compute the difference between corresponding texels in different rasters. Default is 1 that generate a 3x3 kernel. Highest values increase the robustness of the color correction process in the case of strong image-to- geometry misalignments		
✓ Use distance weig	ght	Includes a weight accounting for the distance to the camera during the computation of reference images		
✓ Use image borde	r weight	Includes a weight accounting for the distance to the image border during the computation of reference images		
Use image alpha weight		If true, alpha channel of the image is used as additional weight. In this way it is possible to mask-out parts of the images that should not be projected on the mesh. Please note this is not a transparency effect, but just influences the weigthing between different images		
✓ Clean isolated tria	angles	Remove all patches compound of a single triangle by aggregating them to adjacent patches		
UV stretching		If true, texture coordinates are stretched so as to cover the full interval [0,1] for both directions		
Texture gutter	4	Extra boundary to add to each patch before packing in texture space (in pixels)		
De	fault	Help		
Cl	ose	Apply		

Texture

• Render \rightarrow Show UV Tex Param

