

# CSE590 V : Multi-View Reconstruction

Avanish Kushal

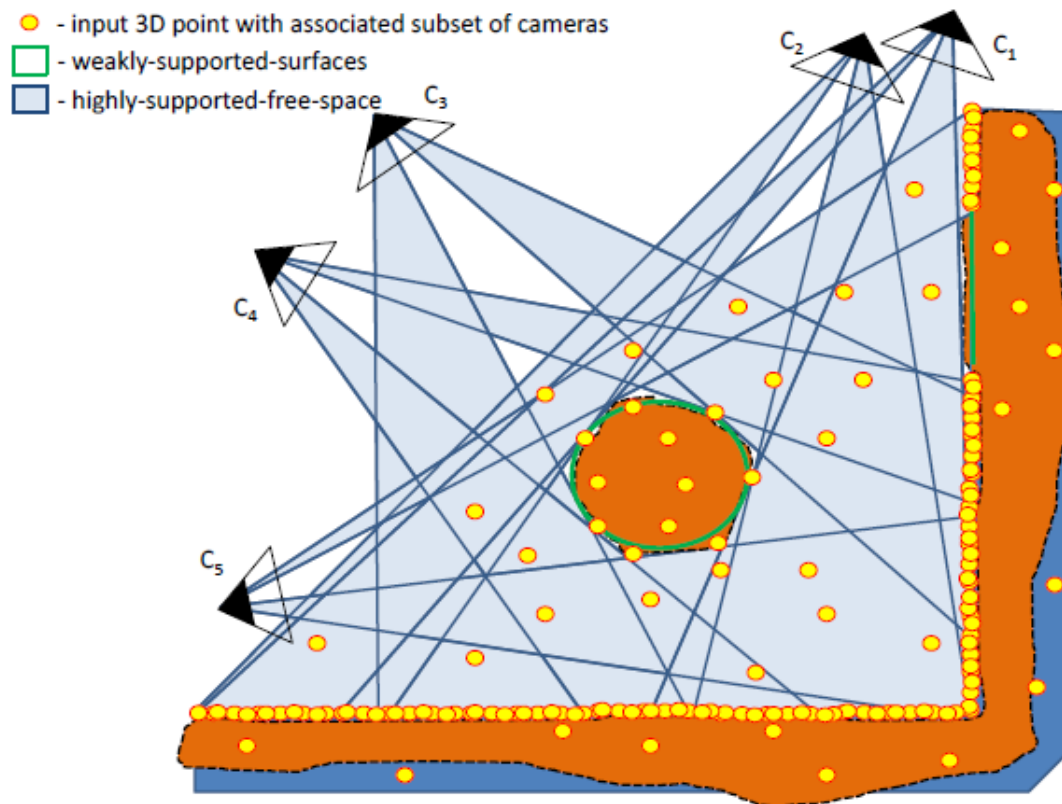
Multi-View Reconstruction  
Preserving Weakly-Supported  
Surfaces [CVPR 2011]

Michael Jancosek

Tomas Padjla

# Motivation

- Reconstruct Surfaces that do not have support in the input 3d point cloud (low textured walls, windows)



Robust and Efficient surface  
reconstruction from range-data  
[CGF- 09]

P. Labatut

J. P. Pons

R. Keriven

# Problem Definition

- Reconstruct a surface from a set of merged scans (noisy and outliers)

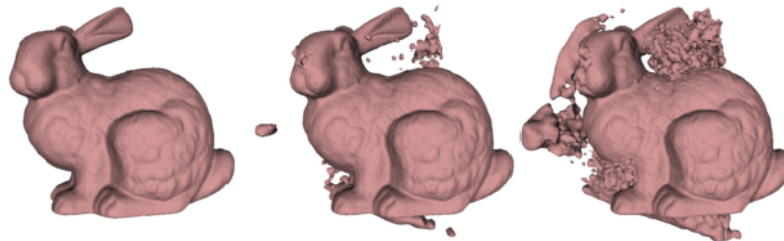


# Related Work

- 2 Primary Themes
  - Implicit Surfaces (Poisson Surface Reconstruction)



(a) Point cloud plus 50,000, 300,000 and 850,000 outliers

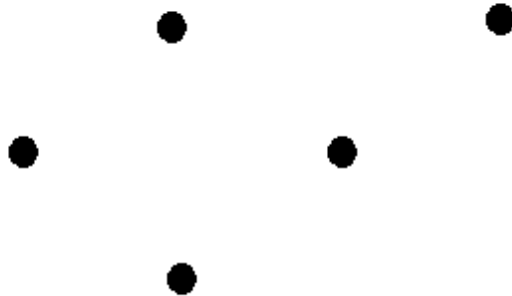


(b) Poisson

- Delaunay Methods

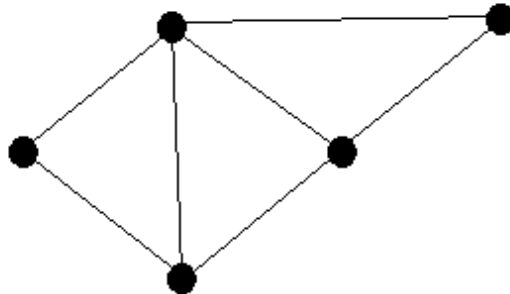
# Algorithm

- Perform a Delaunay Triangulation/  
Tetrahedralization of the 3d point cloud +  
cameras/sensors.



# Algorithm

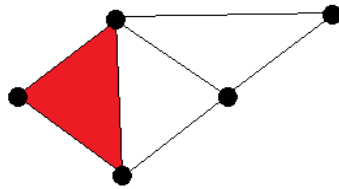
- Perform a Delaunay Triangulation/  
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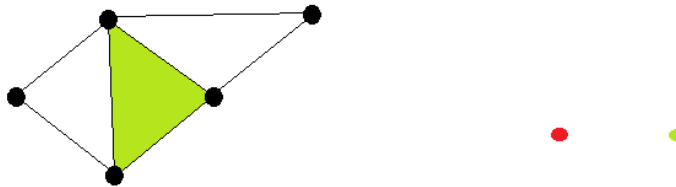
# Algorithm

- Construct a directed graph
  - Each tetrahedron is a vertex



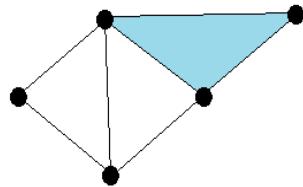
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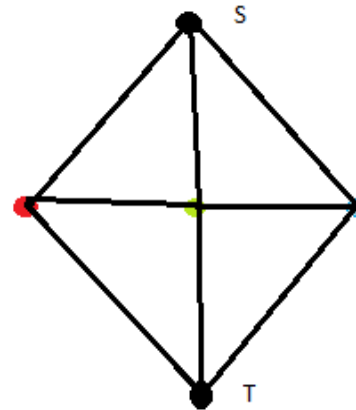
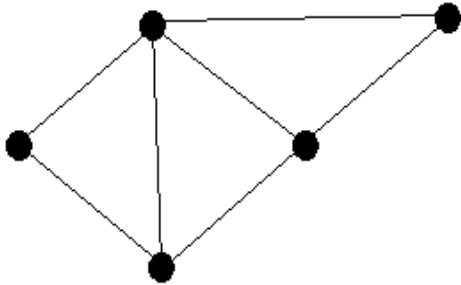
# Algorithm

- Construct a directed graph
  - Each tetrahedron is a vertex



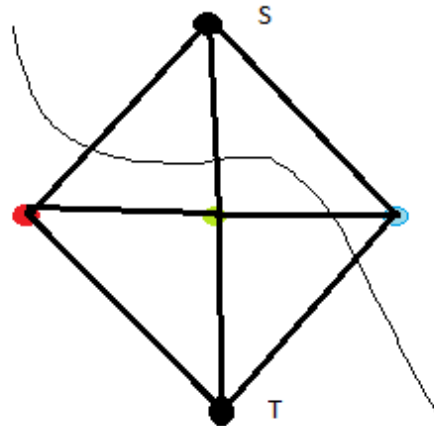
# Algorithm

- Find an s-t cutset of the directed graph
  - An additional s & t vertex



# Algorithm

- Find an s-t cutset of the directed graph
  - The s-t cutset gives the surface



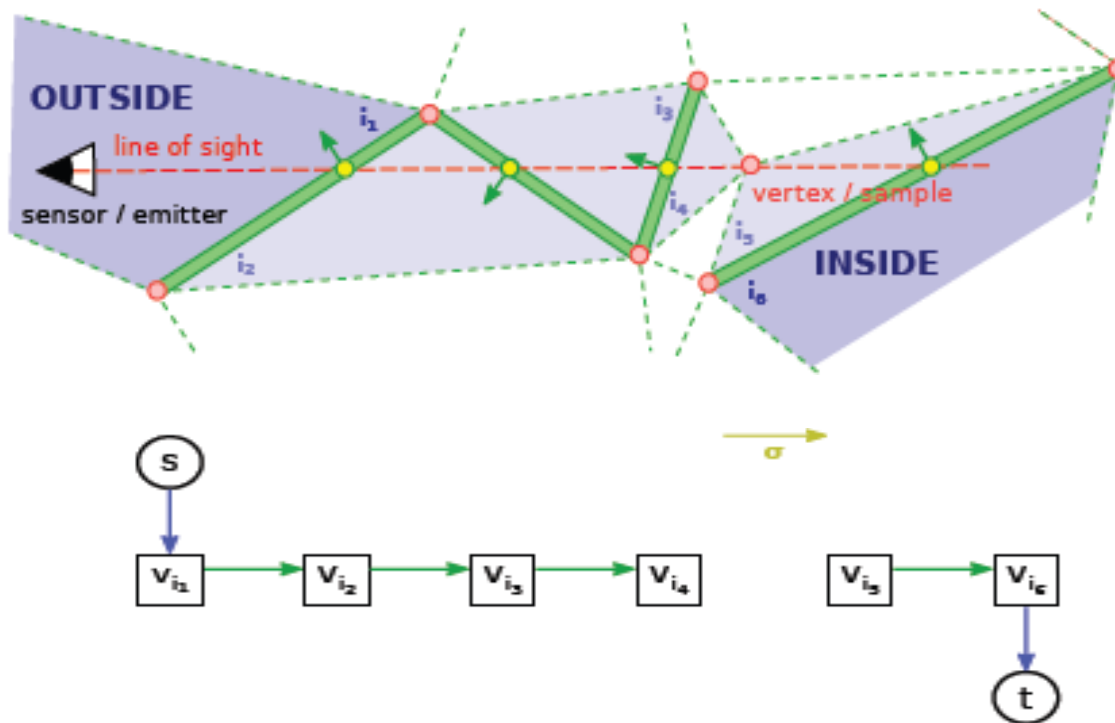
# Formulation

$$E(S) = E_{\text{vis}}(S) + \lambda_{\text{qual}} E_{\text{qual}}(S)$$

$E_{\text{vis}}(S)$  : Visibility Information from points, cameras.

$E_{\text{qual}}(S)$  : Quality of reconstructed surface in terms of size of triangles.

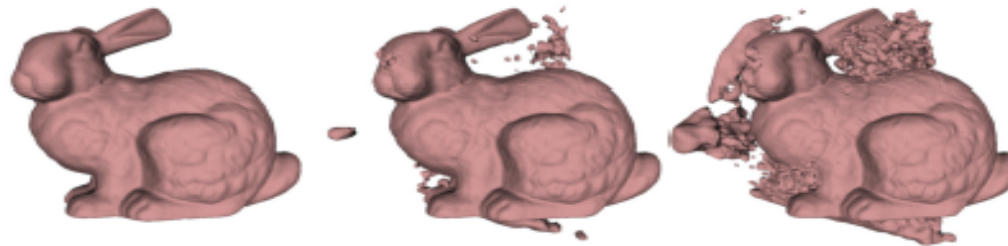
# Surface Visibility



# Results



(a) Point cloud plus 50,000, 300,000 and 850,000 outliers



(b) Poisson



(c) Our method



Multi-View Reconstruction  
Preserving Weakly-Supported  
Surfaces[CVPR 2011]

Michael Jancosek

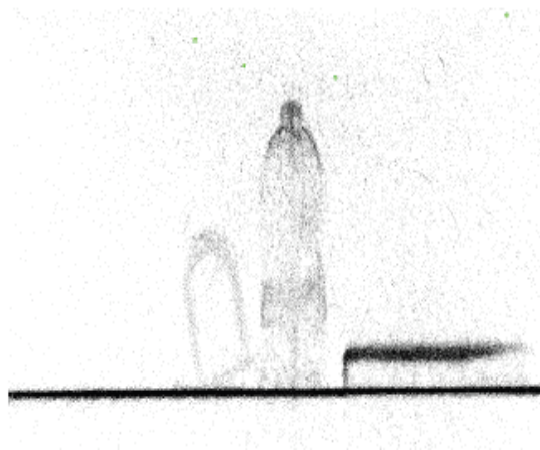
Tomas Padjla

# Problem Definition

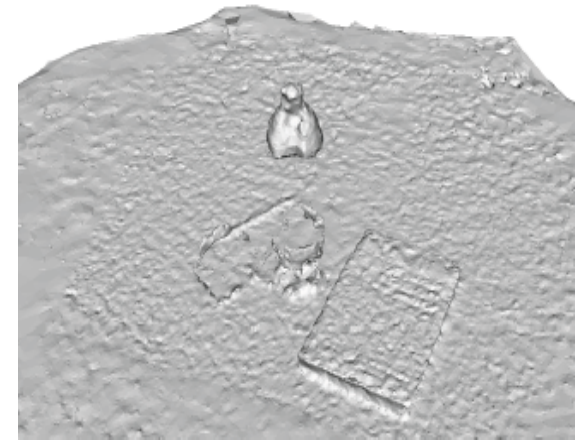
- Reconstruct Surfaces that do not have support in the input 3d point cloud (low textured walls, windows)



Input Image



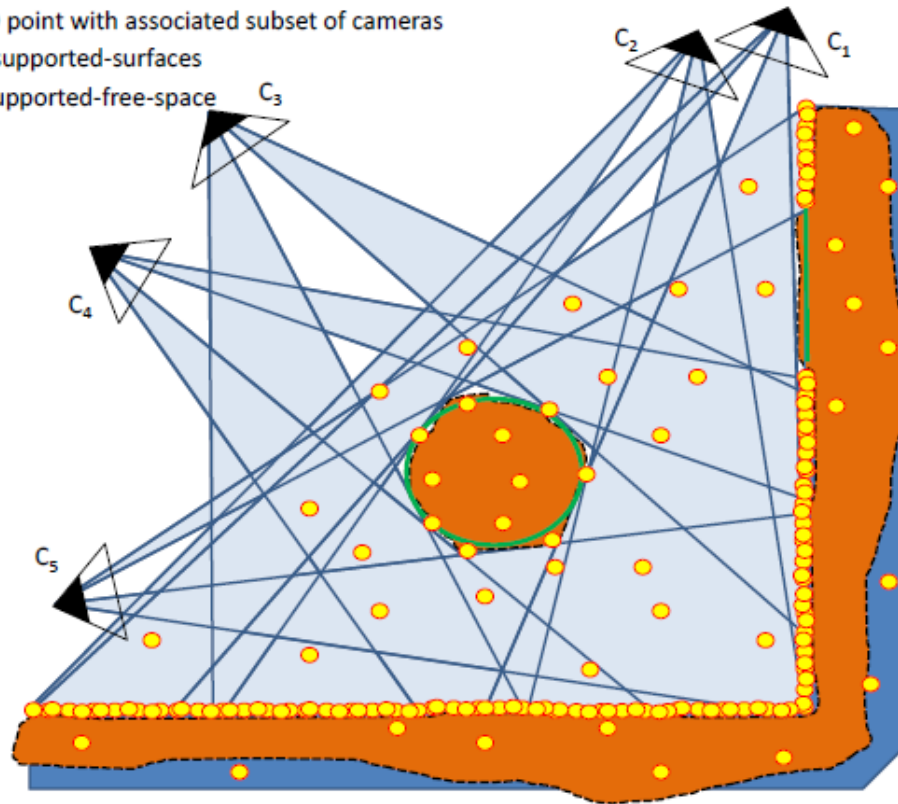
Point Cloud



Reconstructed Surface  
using CFG 09

# Weakly Supported Surfaces

- - input 3D point with associated subset of cameras
- - weakly-supported-surfaces
- - highly-supported-free-space

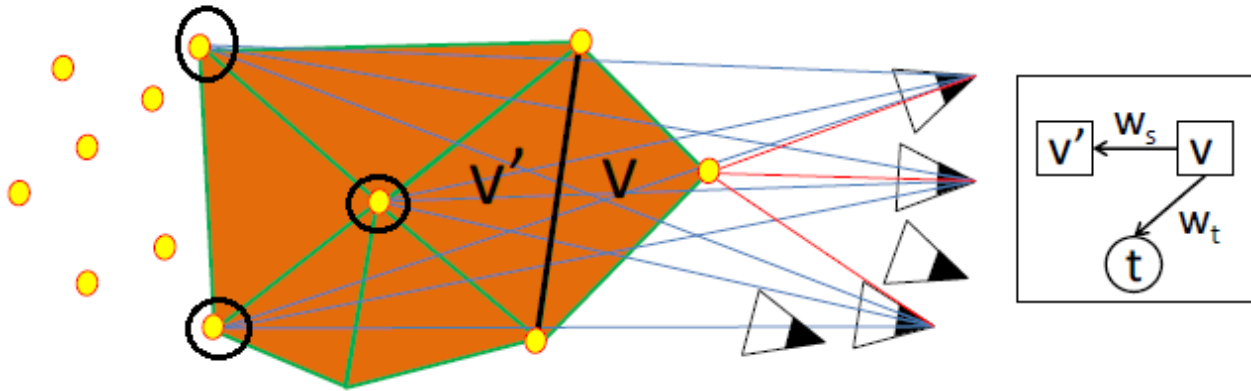


# Key Claim

- Large Jump in Free Space Support as we go from outside to inside.
- Even true for weakly supported surfaces.

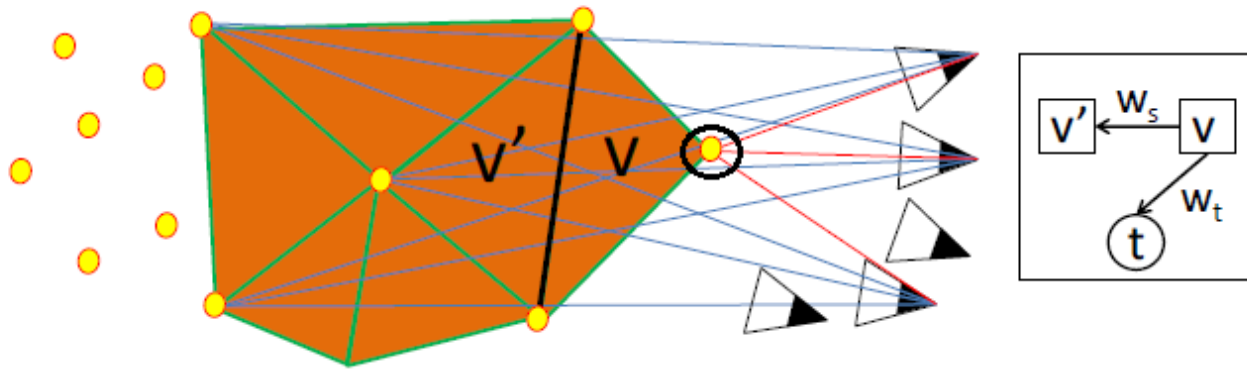
# Weakly Supported Surfaces

- $W_s = 9 (3 * 3)$



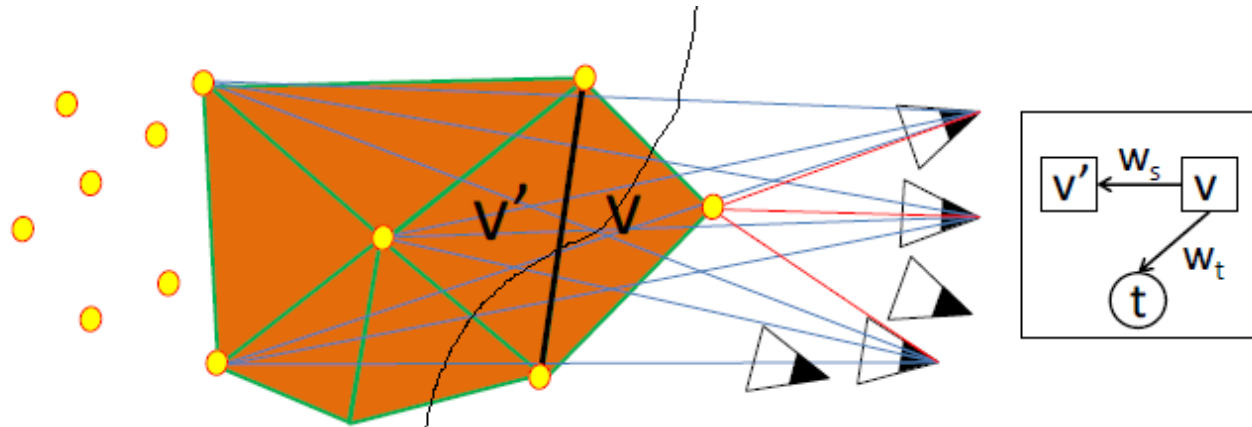
# Weakly Supported Surfaces

- $W_t = 3 ( 1 * 3 )$

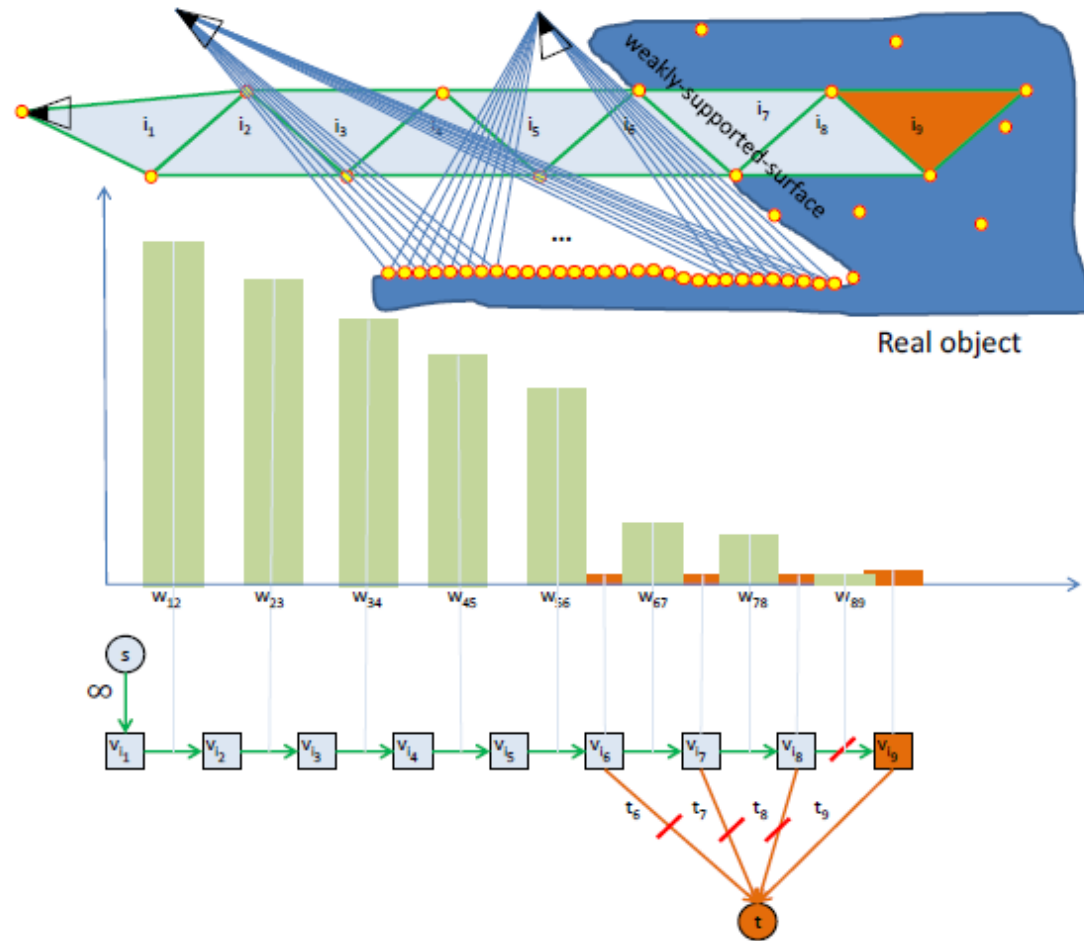


# Weakly Supported Surfaces

- $W_s > W_t \rightarrow$  creates wrong cut.

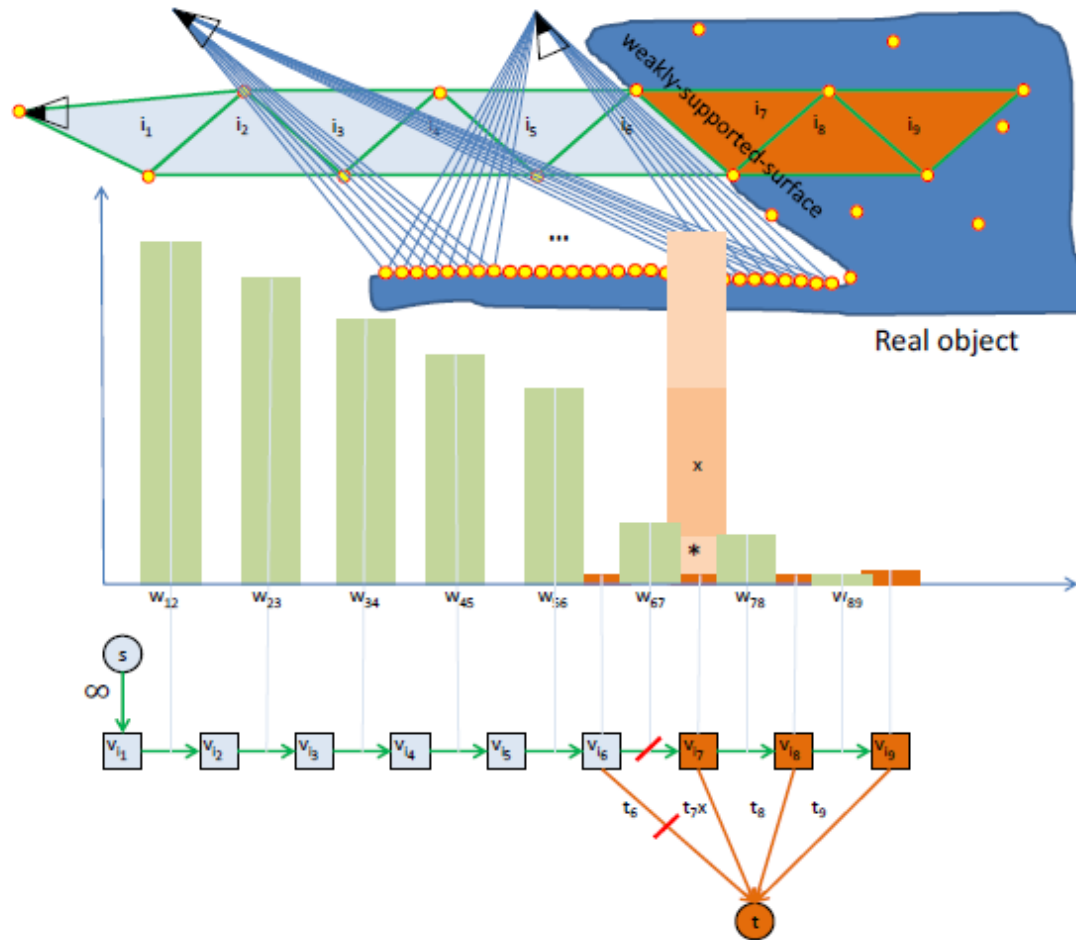


# Old t-weights





# Modified Weights



# Performance

DataSet/Method	Baseline[CFG 09](mins)	Ours(mins)
Castle	30	32
Dragon	90	94

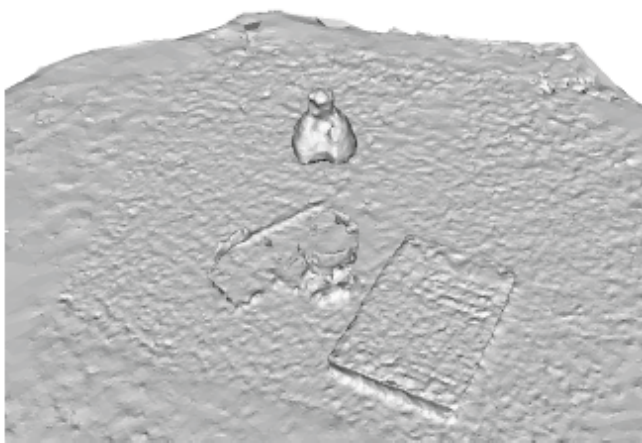
# Results



INPUT IMAGE



POINT CLOUD



CFG-09

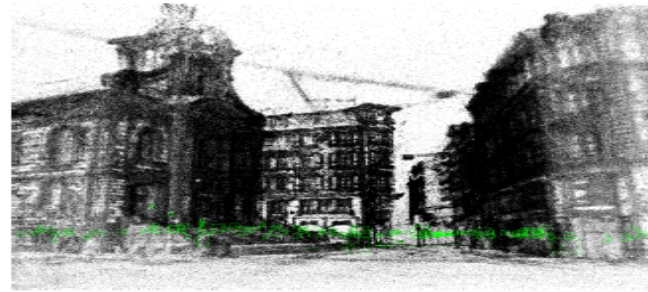


OUR METHOD

# Results



INPUT IMAGE



POINT CLOUD



CFG-09



OUR METHOD



# Results



INPUT IMAGE



POINT CLOUD



CGF-09



OUR METHOD

# Discussion

- How good is the claim about free space jumps ?
- What should be the multiplication term ?