



## Multi-View Stereo : A Parametric Study

Number of images, their angular separation and the like.

# What is Multi-View Stereo.

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- ▶ Take *multiple* 2D (i.e. ordinary) images from different views and convert them into 3D models.
- ▶ 3D Surface is generated from point clouds extracted from 2D images by pairing 2 different images. (i.e. *stereo*)
- ▶ Useful for
  - ▶ Preservation and reconstruction of archeological sites, sculptures.
  - ▶ Speeding up creation of 3D face models for CG Animation purposes.
  - ▶ Making better player generated in-game avatars, quicker.



# Main objectives.

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- ▶ Attempt to generalize, i.e. parameterize, the input requirement by analysis.
- ▶ Mainly considering a time sensitive input acquisition phase.
  - ▶ Time available for taking source pictures is presumed to be limited.
  - ▶ Post processing and 3D Structure generation has fewer constraints.
- ▶ Parameters of most importance :
  - ▶ Number of images.
  - ▶ Angular Separation between two consecutive images.



# The Process

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1. **Input acquisition :**
  1. Any camera that produces standard format digital still images.
2. **Sparse Point Cloud : ( Bundler, Snavely )**
  1. Using Bundler, a Structure from Motion based tool, generate a sparse point cloud.
3. **Dense Point Cloud – Pre-processing (CMVS, Furukawa)**
  1. Applying Clustering methods on large number of images.
4. **Dense Point Cloud – (PMVS, Furukawa)**
  1. From the output cluster, get the final point cloud.
5. **Poisson reconstruction – (Meshlab)**
  1. From points generate 3D Model.



# What is Bundler?

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- ▶ Main purpose is to generate Structure from Motion.
- ▶ Structure from Motion.
  - ▶ Camera Co-ordinates are figured out by using multiple images assumed to be taken in a sequential order.
  - ▶ Most prominent features are extracted and given normal directions. (point clouds)
- ▶ Additional usages
  - ▶ Ease of inputting Camera Parameters.
  - ▶ Processes images and provides a standard output usable by CMVS/PMVS.
  - ▶ Sparse Cloud can be used for time-sensitive preview.

# CMVS and PMVS

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## ▶ Multi-View Stereo :

- ▶ Assume stereo vision and pair two images. (i.e. assume they're taken at the same time)
- ▶ Analyze depth and direction from these views.
- ▶ After computing on numerous pairs, estimate a 3D model.

## ▶ Clustering MVS :

- ▶ Useful largely in cases when number of images is large.
- ▶ Speeds up the process for regular number of images.

## ▶ Patch-based MVS :

- ▶ Creates Dense point cloud from input data.
- ▶ Pre-processing reduced when paired with Bundler.

# Progress Report.

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# Progress Report (cont.)

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- ▶ Able to generate average results from 10 images at 5 degree separation.
- ▶ Lighting conditions and other parameters to be tested.
- ▶ Dataset Used :
  - ▶ Images taken by self.
  - ▶ Plan to use 3D Photography Dataset
    - ▶ <http://www.cs.washington.edu/homes/furukawa/research/mview/index.html>





# Extended Goals.

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- ▶ Try to put harder constraints on 3D point cloud generation.
- ▶ Derive a parametric formula based on Vehicular motion, i.e.
  - ▶ “What should be the time gap between images”
  - ▶ “What should be the angular motion of vehicle around the object of interest”
  - ▶ “If path known and fixed, what should be the optimal timing”
- ▶ Try different algorithms cited in Middlebury
  - ▶ <http://vision.middlebury.edu/mview>



# Thank You for Listening.

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▶ Any Questions?

