# Interference-free Epipole-centered Structured Light Pattern for Mirror-based Multi-view Active Stereo

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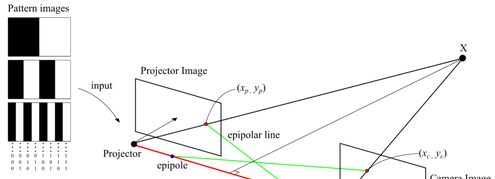
## Motivation

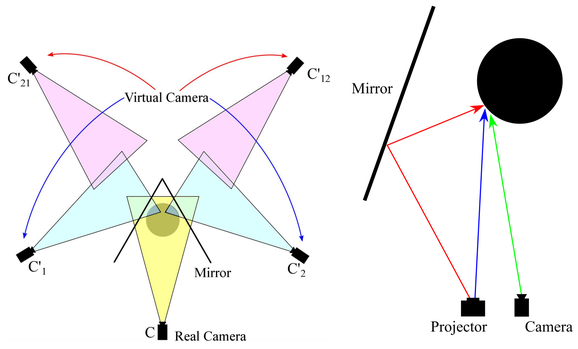
Full 3D capture using a perspective projector-camera pair

- Active stereo with structured lighting
- Virtual multi-view system by mirrors




## Challenge

Interferences between direct-indirect illuminations





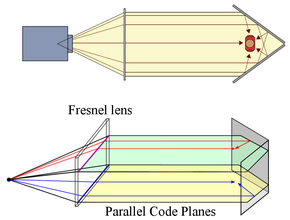


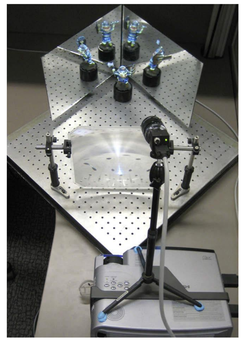
Interference (or code collision) occurs where the object is illuminated directly from the projector and indirectly via the mirror.

## Related Work

Orthographic pattern projection transforms horizontal line patterns to parallel code planes. If the mirrors are perpendicular to the planes, codes cannot collide each other.

1. Orthographic projector is required
2. Physical alignment is required

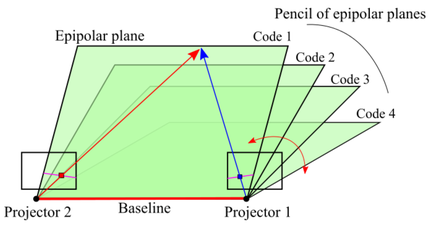


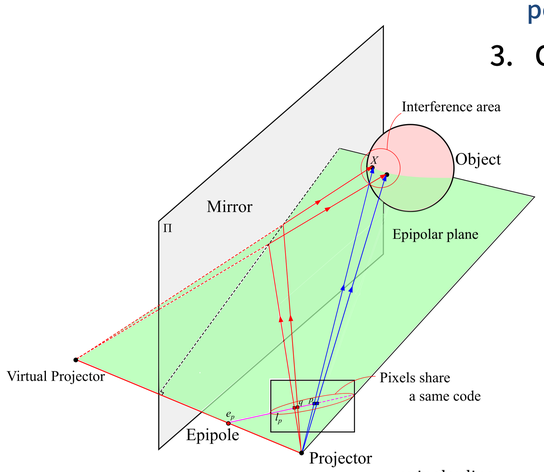
[16]Lanman et al. Surround structured lightning: 3-D scanning with orthographic illumination,CVIU(2009)

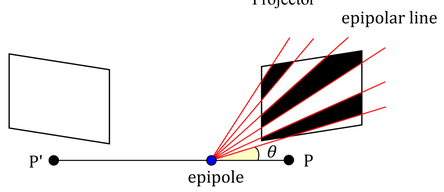
## Idea

Epipole-centered Structured Light Pattern




1. Decomposition of the target space into the pencil of epipolar planes.
2. A projected ray lies on a single epipolar plane.
   Any pair of real and virtual pixels under the interference (illuminating a same 3D point) is on a same epipolar plane.
3. Code assignment per epipolar planes



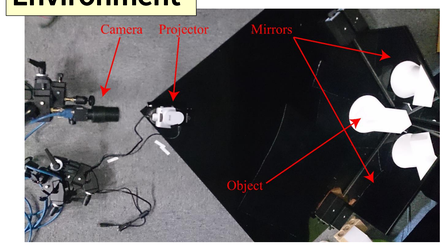




### Epipole-centered structured light pattern

- Collision-free (interference-free)
- Polar coordinate pixel position encoding
  - Polar angle only.
  - Radial position is given by camera-projector epipolar geometry.

## Experimental Result

**Environment**

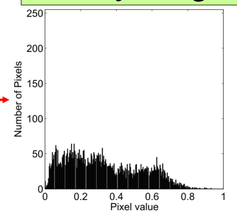



Generated patterns need to be projected per mirrors

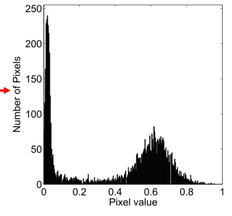
**Conventional patterns**

**Zoom**

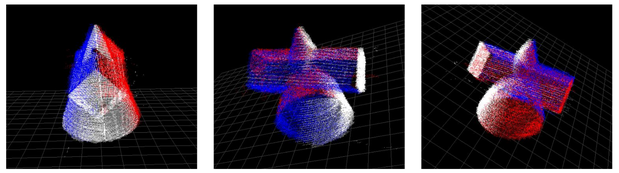
**Intensity histogram**




**Proposed patterns**




**Reconstruction Result**



## Conclusion

Collision-free structured light pattern for perspective projector

### Limitations

- Projector pattern aliasing
- Apply on the multiple reflections environment
- Interference between different mirrors

**Multiple reflections**