

Spacetime Stereo: A Unifying Framework for Depth from Triangulation

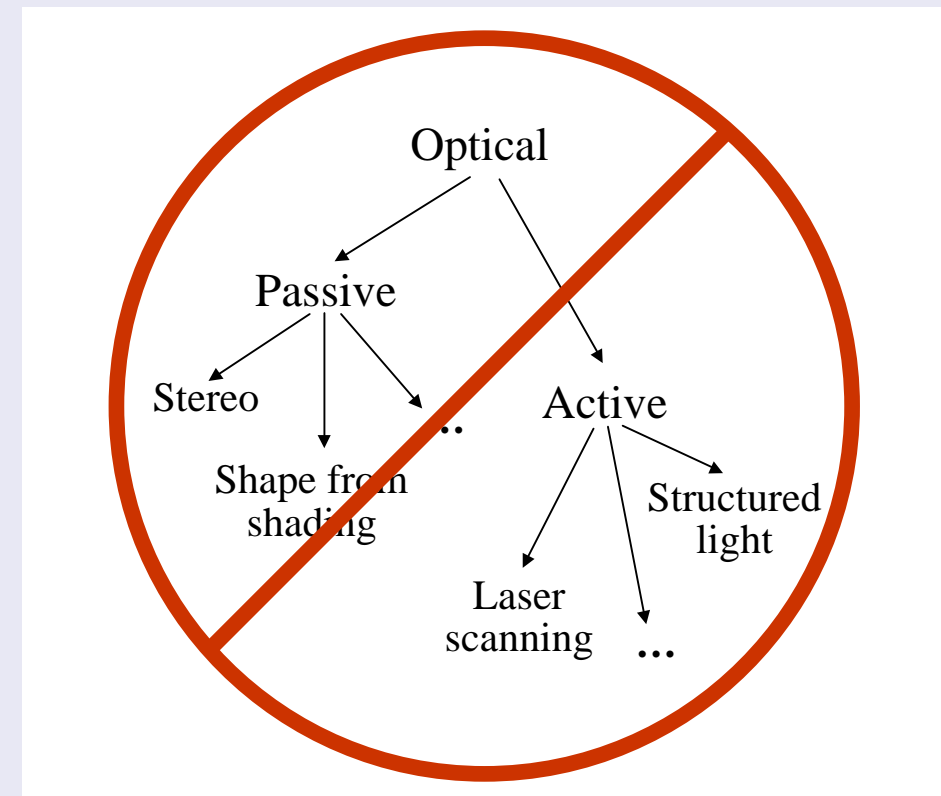
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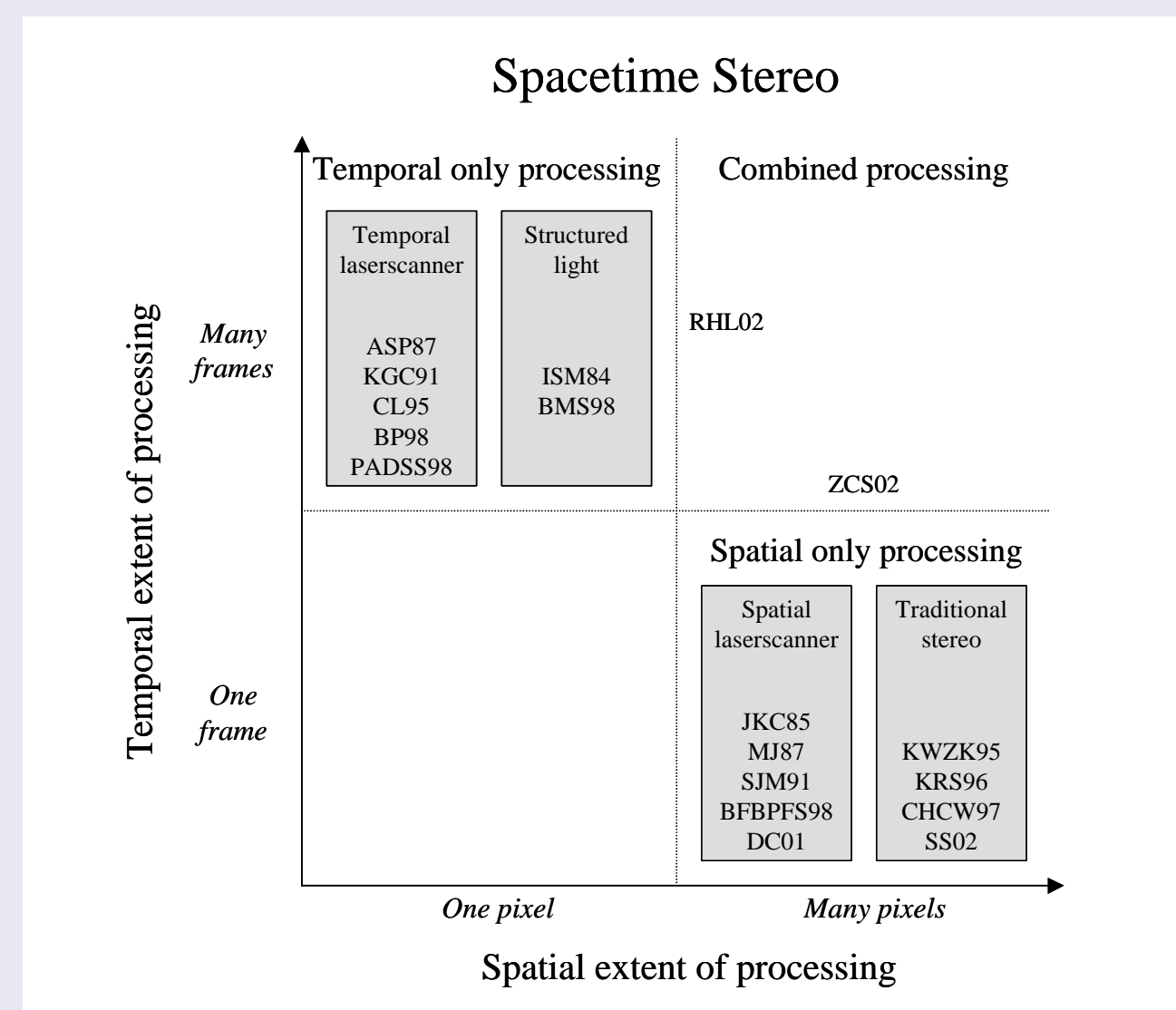
Old Taxonomy

Classifying systems as passive or active has led to a separation in the literature of triangulation methods which are closely related.



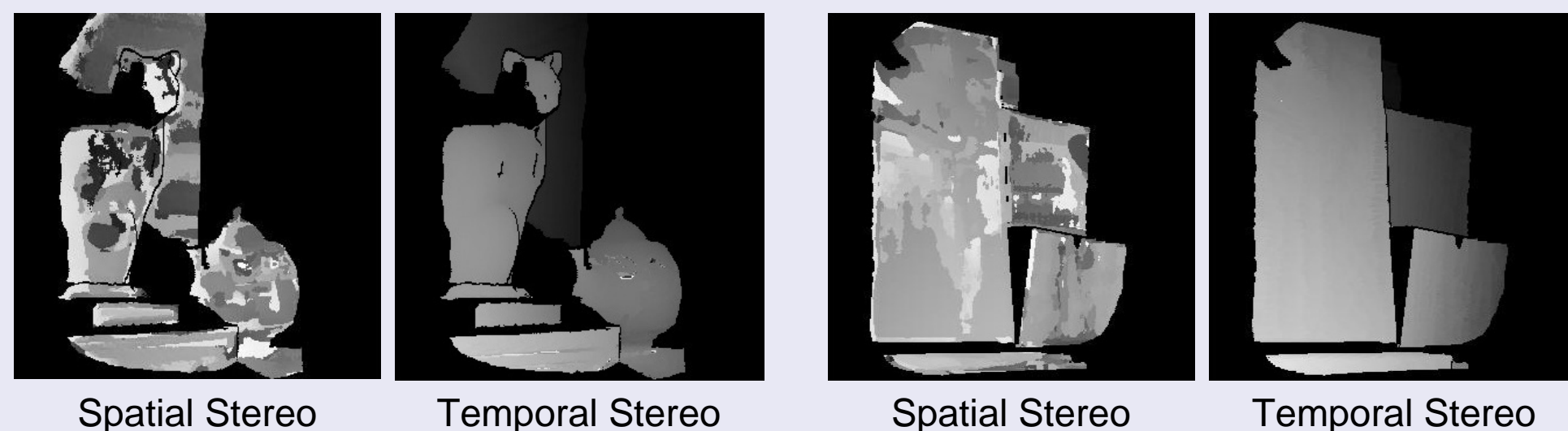
New Taxonomy

Unifying triangulation methods within the spacetime framework allows new hybrid algorithms to be easily identified.



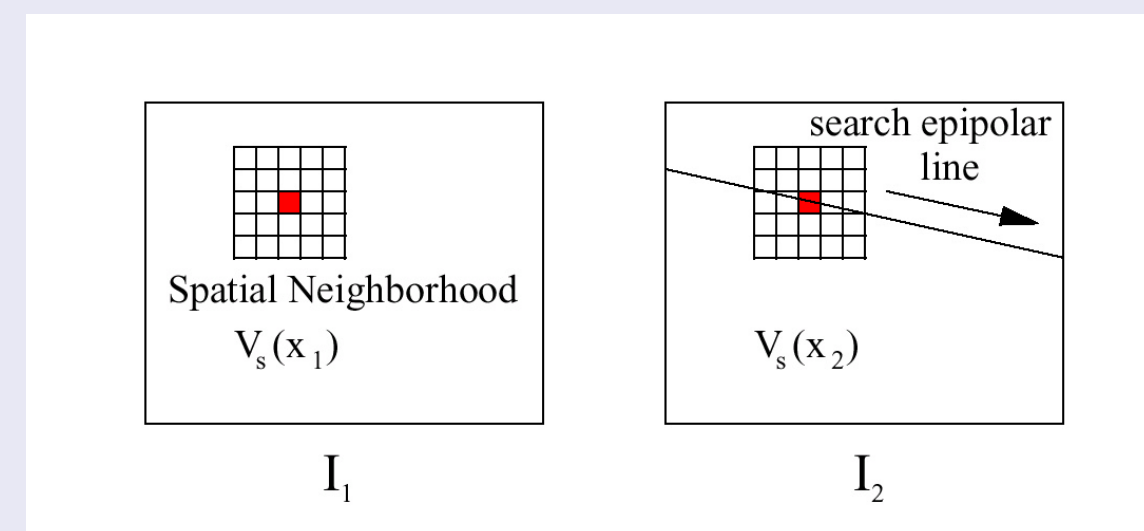
Improved Algorithm

Temporal stereo is a new hybrid algorithm which allows improved reconstruction of static scenes with unstructured variable lighting.



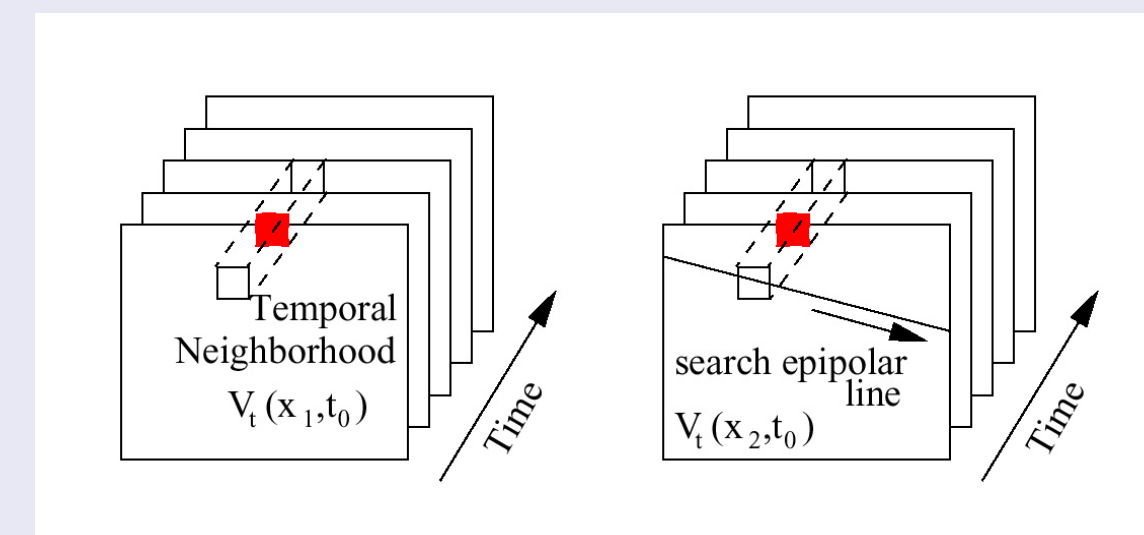
Traditional Spatial Stereo

Traditional stereo searches for correspondence using a spatial matching window. This window reduces ambiguity when spatial texture is present.



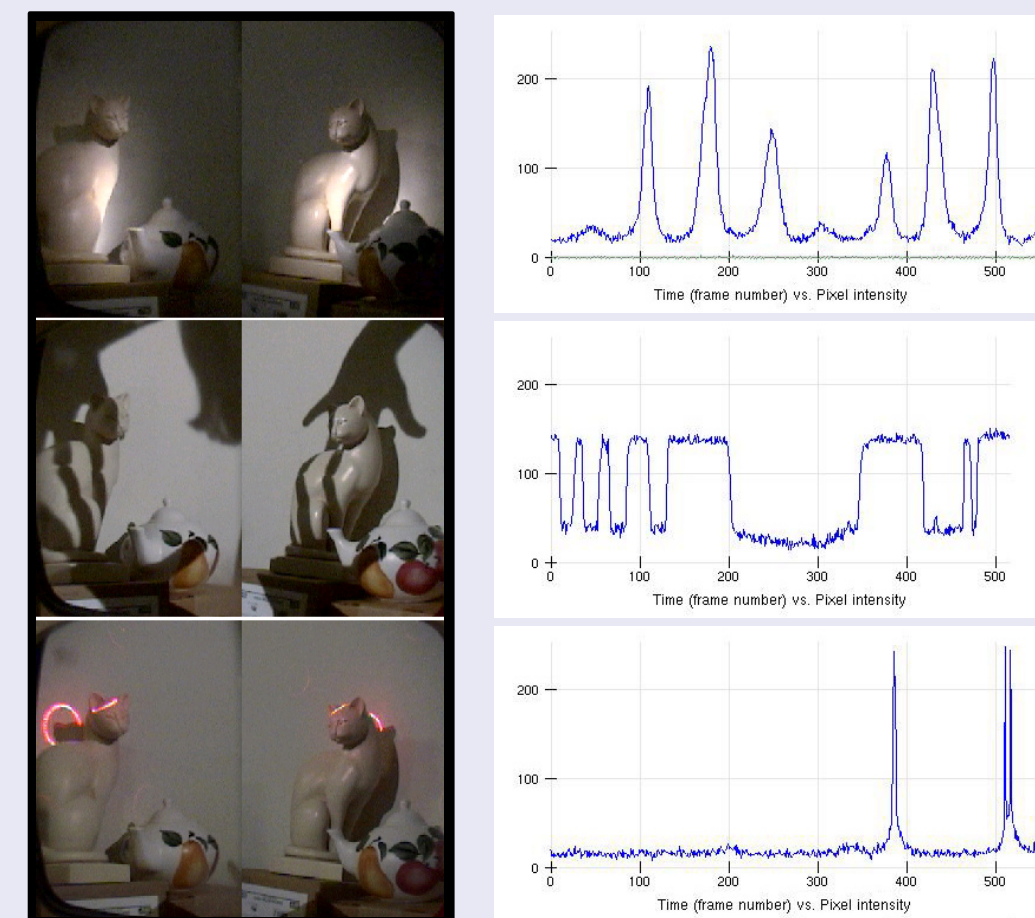
Temporal Stereo

A temporal matching window can be used to establish correspondence when unstructured light variation or other temporal texture is present.



Example Temporal Patterns

The temporal texture at an individual pixel will depend on the nature of the lighting variation. Flashlights, shadows and lasers all produce unique texture.

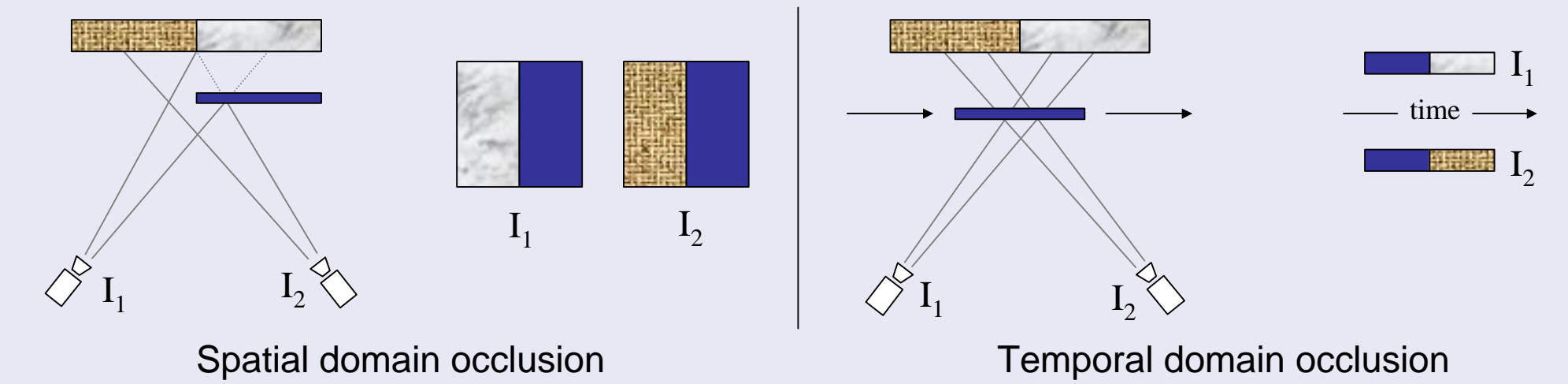


Spacetime Stereo

The matching window should not necessarily lie entirely within the spatial or temporal domains. A *spatial-temporal* matching window may be desirable.

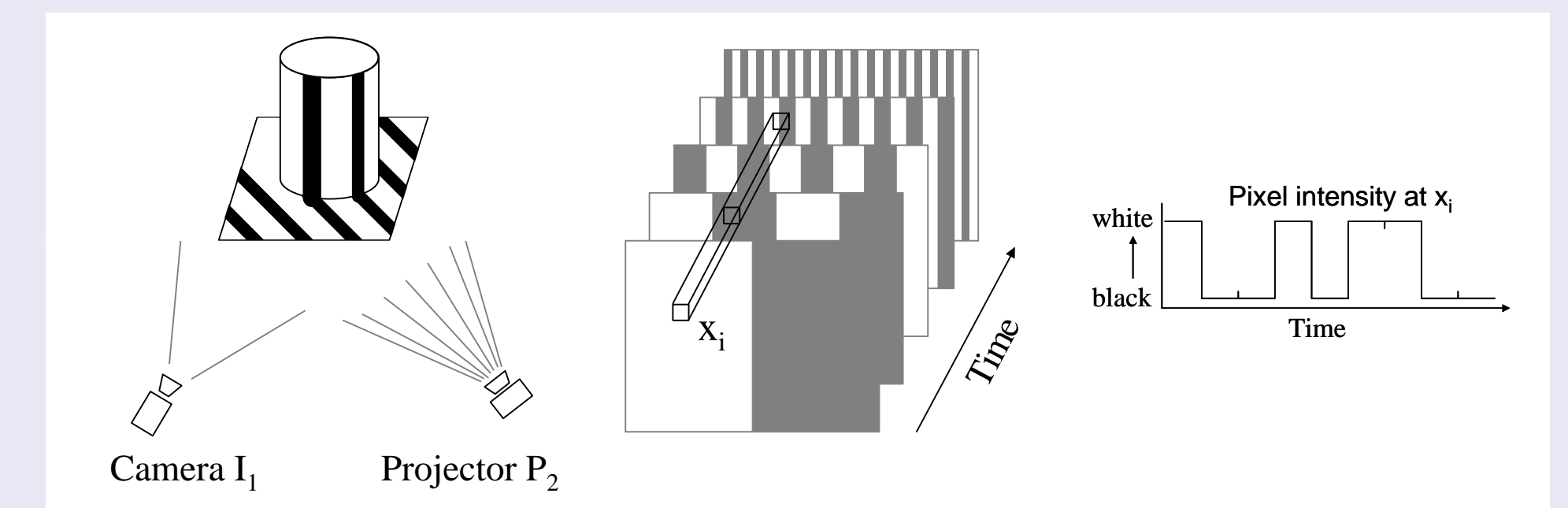
Moving Objects

Moving objects cause errors in temporal matching that are analogous to errors caused by object discontinuities in spatial matching.



Structured Light

Structured light methods project a sequence of coded patterns onto objects to determine depth. Treating these patterns as temporal texture rather than as known codes, allows multiple structured light systems to be used together.



Laser Scanning

Laser scanners use a single stripe of light to disambiguate correspondence. Treating this light as texture rather than as a Gaussian feature can relax calibration requirements and prevent interreflections from causing ambiguity.

