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Structure from Motion using Tomasi-Kanade Factorization, SIFT and RANSAC

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In earlier literature mostly two frames were used to estimate the 3-D structure, while recent approaches make use of a long sequence of frames. The latter gives a better recovery of structure because it amasses temporal information over time instants. Tomasi-Kanade factorization also assumes all features to be visible in the entire image stream. This results in a dense 2-D cloud and thus recovers, fully, the 3-D structure.

This paper handles the problem of structure from motion using Tomasi-Kanade factorization method applied on a sequence of frames. Orthographic projection is assumed here and singular value decomposition technique is used to factor the measurement matrix (W) into two matrices which corresponds to object's 3-D structure (S) and camera rotation (R) respectively. To construct W, feature correspondences are established by a SIFT tracker and next RANSAC is used to remove the false matches detected by SIFT tracker. The 3-D pointcloud (S) is converted to a mesh of triangles by connecting the nearest three points. Further, the mesh of triangles is rendered via a tool called plyview from CyberWare to get the final structure.