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HIGH-RESOLUTION SURFACE RECONSTRUCTION FROM IMAGERY FOR CLOSE RANGE CULTURAL HERITAGE APPLICATIONS

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Abstract. The recording of high resolution point clouds with sub-mm resolution is a demanding and cost intensive task, especially with current equipment like handheld laser scanners. We present an image based approached, where techniques of image matching and dense surface reconstruction are combined with a compact and affordable rig of off-the-shelf industry cameras. Such cameras provide high spatial resolution with low radiometric noise, which enables a one-shot solution and thus an efficient data acquisition while satisfying high accuracy requirements. However, the largest drawback of image based solutions is often the acquisition of surfaces with low texture where the image matching process might fail. Thus, an additional structured light projector is employed, represented here by the pseudo-random pattern projector of the *Microsoft Kinect*. Its strong infrared-laser projects speckles of different sizes. By using dense image matching techniques on the acquired images, a 3D point can be derived for almost each pixel. The use of multiple cameras enables the acquisition of a high resolution point cloud with high accuracy for each shot. For the proposed system up to 3.5 Mio. 3D points with sub-mm accuracy can be derived per shot. The registration of multiple shots is performed by *Structure and Motion* reconstruction techniques, where feature points are used to derive the camera positions and rotations automatically without initial information.

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