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A VARIATIONAL APPROACH TO CAMERA MOTION SMOOTHING

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Abstract. In this paper we study a variational problem derived from a computer vision application: video camera calibration with smoothing constraint. By video camera calibration we mean to estimate the location, orientation and lens zoom-setting of the camera for each video frame taking into account image visible features. To simplify the problem we assume that the camera is mounted on a tripod, in such case, for each frame captured at time t, the calibration is provided by 3 parameters : (1) $P(t)$ (PAN) which represents the tripod vertical axis rotation, (2) $T(t)$ (TILT) which represents the tripod horizontal axis rotation and (3) $Z(t)$ (CAMERA ZOOM) the camera lens zoom setting. The calibration function $t \to \mathbf{u}(t) = (P(t), T(t), Z(t))$ is obtained as the minima of an energy function $I[\mathbf{u}]$. In this paper we study the existence of minima of such energy function as well as the solutions of the associated Euler-Lagrange equations.

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