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COMPUTER SCIENCE COLLOQUIUM

Computer Vision to Animate Vision

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Abstract: The disciplines of Biological Vision and Physical Optics have been studied as a subject of their own right and have been an inspiration to early research in Computer Vision. Over the decades the latter field has however matured into a somewhat closed study of the use of pinhole models and flat CCD chips. The result is a largely stagnating field with a number of inherent and severe problems. This colloquium will put forward three suggestions of a careful revisit to the origin of image formation and of modelling of biological vision in order to create mathematical-algorithmic vision paradigms that overcome such problems.

Firstly, the virtues of ancient 3D integral photography are combined with new 3D sensors, and it is shortly hinted, that such arrangements might very well overcome quite a number of classic ambiguity and scaling problems in computer vision.

Secondly, biophysics experimentation tells that a revised concept of shape descriptors is a close conclusion to draw in order to mimic 3D human visual perception capabilities of objects in computer vision. Classic differential geometry needs to be supplemented with these or eventual completely abandoned for the purpose.

Thirdly, the concept of scale space seems a fruitful mathematical modelling concept in several aspects of algorithmic vision. The issue of general Scale-Selection is addressed. At least three views of image structure exist in the image processing community: Mathematical morphology, in which the shapes of the image isophotes are studied, diffusion scale-spaces that examine the linear or non-linear mean value of neighbouring pixels, and statistical methods that study the full distribution of local neighbourhoods. Seemingly far apart, these views are currently converging. Morphological erosion and dilation scale-spaces and the linear-diffusion scale-space are related through a non-linear transformation of the grey-values. Additionally, the notion of locally disorderly images has been introduced, that facilitates the availability of the simple Gaussian structure for local statistical analysis. The goal of this paper is to reveal the relation between grey-value transforms and local soft histograms, and to suggest a generalised scale-selection mechanism.

Host: Kim Skak Larsen