Abstract

This thesis is an effort in the direction of exploring the alternative computational paradigms of the *artificial neural networks* for robust solutions to some of the problems of computer vision. In the present work, it has been shown that the lack of knowledge of the exact reflectance models in the shading based paradigms and also the dependence of the motion based paradigms on feature detection, correspondence and numerical computation of local gradients can be identified as the central problems of the conventional frameworks formulated for 3-D perception. In search of robust solutions to these problems and motivated by the ideas of the emerging schools of *active perception* and *neuro-vision*, the objective of the present work has been to investigate the suitability and adequacy of one of the most stable and generally applicable ANN paradigms, namely, the *feedforward networks* with the *backpropagation* learning algorithm for robustifying the extraction and integration of the 3-D information from multiple visual cues. In this pursuit, the specific problems of photometric stereo inversion of real-world reflectance maps and of estimating the instantaneous image motions from the motion stereo images have been addressed and a feedforward neural networks based approach has been proposed for robust solutions to each of these problems. Further, a locally connected cellular neural network has been proposed for the integration of the dense orientation maps and the sparse depth maps estimated by the feedfoward networks from the photometric stereo and the motion stereo images respectively. A significant emphasis in the present work has been towards the development of a framework for efficiently using the learning abilities and the robustness of the feedforward neural networks, which seem to have been under-exploited in the computer vision research, for stable solutions to these problems.