

Preface

The problem of active sensor planning was firstly addressed about 20 years ago and attracted many people after then. Recently, active sensing becomes even more important than ever since a number of advanced robots are available now and many tasks require to act actively for obtaining 3D visual information from different aspects. Just like human beings, it's unimaginable if without active vision even only in one minute. Being active, the active sensor planner is able to manipulate sensing parameters in a controlled manner and performs active behaviors, such as active sensing, active placement, active calibration, active model construction, active illumination, etc. Active vision perception is an essential means of fulfilling such vision tasks that need take intentional actions, e.g. entire reconstruction of an unknown object or dimensional inspection of an industrial workpiece.

The intentional actions introduce active or purposive behaviors. The vision system (the observer) takes intentional actions according to its mind, the mind such as going to a specific location and obtaining the useful information of the target, in an uncertain environment and conditions. It has a strategic plan to finish a certain vision task, such as navigating through an unfamiliar environment or modeling of an unknown object. It is capable of executing the plan despite the presence of unanticipated objects and noisy sensors.

A multi-view strategy is often required for seeing object features from optimal placements since vision sensors have limited field of view and can only "see" a portion of a scene from a single viewpoint. This means that the performance of a vision sensor depends heavily both on the type and number of sensors and on the configuration of each sensor. What important is that the sensor is active. Compared with the typical passive vision where it is limited to what is offered by the preset visual parameters and environmental conditions, the active planner can instead determine how to view by utilizing its capability to change its visual parameters according to the scene for a specific task at any time.

From this idea, many problems have to be considered in constructing an active perception system and these important problems lead our motivation of the research on active sensor and sensing techniques. For many practical vision tasks, because, it is very necessary to develop a multiview plan of control strategy, and these viewpoints can be decided either offline or in run-time.

The purpose of this book is to introduce the challenging problems and propose some possible solutions. The main topics addressed are from both theoretical and technical aspects, including sensing activity, configuration, calibration, sensor modeling, sensing constraints, sensing evaluation, viewpoint decision, sensor placement graph, model based planning, path planning, planning for

unknown environment, incremental 3D model construction, measurement, and surface analysis.

With our acknowledgements, the research work in this book was supported by the Research Grants Council of Hong Kong, the Natural Science Foundation of China, and the Alexander von Humboldt Foundation of Germany. Several colleagues, Z. Liu, B. He, B. Zhang, H. Zhang, and T. Tetsis, have contributed in part with the research work, experiments, and writing.

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Active Sensor Planning for Multiview Vision Tasks

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2008, XI, 265 p., Hardcover

ISBN: 978-3-540-77071-8