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EVALUATION OF PENALTY FUNCTIONS FOR SEMI-GLOBAL MATCHING COST AGGREGATION

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Abstract. The stereo matching method semi-global matching (SGM) relies on consistency constraints during the cost aggregation which are enforced by so-called penalty terms. This paper proposes new and evaluates four penalty functions for SGM. Due to mutual dependencies, two types of matching cost calculation, census and rank transform, are considered. Performance is measured using original and degenerated images exhibiting radiometric changes and noise from the Middlebury benchmark. The two best performing penalty functions are inversely proportional and negatively linear to the intensity gradient and perform equally with 6.05% and 5.91% average error, respectively. The experiments also show that adaptive penalty terms are mandatory when dealing with difficult imaging conditions. Consequently, for highest algorithmic performance in real-world systems, selection of a suitable penalty function and thorough parametrization with respect to the expected image quality is essential.

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