

Machines that See, Powered by Probability

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ABSTRACT

Machines with some kind of ability to see have become a reality in the last decade, and we see vision capabilities in cameras and photography, cars, graphics software and in the user interfaces to appliances. Such machines bring benefits to safety, consumer experiences, and healthcare, and their operation is based on mathematical ideas.

The visible world is inherently ambiguous and uncertain so estimation of physical properties by machine vision often relies on probabilistic methods. Prior distributions over shape can help significantly to make estimators for finding and tracking objects more robust. Learned distributions for colour and texture are used to make the estimators more discriminative. These ideas fit into a philosophy of vision as inference: exploring hypotheses for the contents of a scene that explain an image as fully as possible. More recently this explanatory approach has partly given way to powerful, direct estimation methods, whose operating parameters are learned from large data sets. Perhaps the most capable vision systems will come ultimately from some kind of fusion of the two approaches.