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Micro-Manipulation Using Learned Model

Matthew A. Lyng, Benjamin V. Johnson, and David J. Cappelleri
Department of Mechanical Engineering, Purdue University

ABSTRACT

Microscale devices can be found in applications ranging from sensors to structural components. The dominance of surface forces at the microscale hinders the assembly processes through nonlinear interactions that are difficult to model for automation, limiting designs of microsystems to primarily monolithic structures. Methods for modeling surface forces must be presented for viable manufacturing of devices consisting of multiple microparts. This paper proposes the implementation of supervised machine learning models to aid in automated micromanipulation tasks for advanced manufacturing applications. The developed models use sets of training data to implicitly model surface interactions and predict end-effector placement and paths that will yield a desired part trajectory. Conclusions and recommendations are based on evaluations of a collection of machine learning models and the effects of training data size and hyperparameter tuning on a collection of error metrics.

KEYWORDS

Micromanipulation, machine learning, automation, manufacturing, modeling