UNIVERSITY OF SOUTH FLORIDA

Defense of a Doctoral Dissertation

Functional Object-Oriented Network: A Knowledge Representation for Service Robotics

by

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For the Ph.D. degree in Computer Science & Engineering

Motivated by the theory of affordance, this dissertation introduces the functional object-oriented network (FOON), which is a graphical knowledge representation that captures sequences of manipulations required for household activities, specifically cooking, as nodes. The novelty in FOON lies in its wide array of knowledge that spans variations of recipes and demonstrations. Robots using a FOON as a knowledge base can acquire a task plan, known as a task tree, that describes how a robot can finish a task of preparing a meal from start to end. A FOON can be tailored to different robots based on their ability to perform tasks, and we show how this can be done with a real robotic system. As a complementary addition to FOON, in order to translate motions in a way that robots can understand, we also introduce and discuss the motion taxonomy, which is used to embed motions based on mechanics.

Examining Committee

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Publications

D. Paulius, Y. Huang, J. Meloncon, and Y. Sun, "Manipulation Motion Taxonomy and Coding for Robots", (IROS 2019)

D. Paulius and Y. Sun, "A Survey of Knowledge Representation in Service Robotics", Robotics and Autonomous Systems 118, 13-30, July 2019

A. B. Jelodar, D. Paulius and Y. Sun, "Long Video Activity Understanding using Functional Object-Oriented Network", IEEE Transactions on Multimedia, 2019

D. Paulius, A. B. Jelodar and Y. Sun, "Functional Object-Oriented Network: Construction & Expansion", (ICRA 2018)

D. Paulius, Y. Huang, R. Milton, W. D. Buchanan, J. Sam and Y. Sun, "Functional Object-Oriented Network for Manipulation Learning", (IROS 2016)

M. Alibayev, D. Paulius, and Y. Sun, "Improved Motion Recognition using Motion Taxonomy", (Submitted to IROS 2020)

D. Paulius, K. S. P. Dong, and Y. Sun, "A Weighted Functional Object-Oriented Netwoork for Task Planning", (Submitted to RAS)

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