Supervised Learning Of Hidden and Non-Hidden 0-order Affordances

Aitor Aldoma, Markus Vincze
ACIN - Vienna University of Technology
aldoma,vincze@tuwien.ac.at

Federico Tombari
Computer Vision Lab
DEIS - ARCES, University of Bologna
federico.tombari@unibo.it

***Abstract*—**

I. INTRODUCTION

From a robotic perspective being able to understand a scene and moreover, understanding which are the interaction possibilities that are provided in a specific environment, are a key capability for a task-guided robotic agent. What an environment affords depends strongly on two factors: (i) the objects and their configuration in the world and second, the interaction capabilities embodied on a specific agent. The combination of both factors is coined under the term affordance in the literature:

> "Affordances relate the utility of things, events, and places to the needs of animals and their actions in fulfilling them [...]. Affordances themselves are perceived and, in fact, are the essence of what we perceive."

This quote provides an intuitive definition of the term affordance and moreover, poses an opportunity to motivate our analysis on affordances from a robotic perspective.

The affordances of an object - what we term under 0-order affordances - are supported by geometrical -local or global- properties of the object. For instance, objects like chairs or sofas can be used for sitting as they provide a parallel surface to the ground and a perpendicular one used to lean back and mugs, bowls and in general containers, are used for liquid-containment because they provide a closed concavity. 0-order affordances do not depend solely on the geometry of the objects but also on their configuration in the world. Liquid containers can only fulfill their function if they are in an upright pose or objects like sofas and chair can be used for sitting when found in a specific pose.

The following NEEDS TO BE STRUCTURED AND PHRASED PROPERLY!!

Moreover, if we think about perceiving affordances directly from a certain viewpoint, things get even more interesting as the ... TODO: for example a chair seen from behind does not afford sittable ...

From a robotics perspective, do we really want to be able to ONLY perceive affordances when directly perceivable.... We can manipulate the environment ... Contradict Gibson!!

Object recognition based on CAD models...

Supervised-Learning of affordances based on geometry for CAD models...

Talk about why stable poses can used for this things because we live in an structured environment and man-made objects have been designed to fulfill their functions usually when found in a certain stable pose... Objects that fulfill the same function share at least one stable plane!!

If we solve object recognition =¿ we get a direct mapping for affordances

II. RELATED WORK

III. LEARNING 0-ORDER AFFORDANCES

Which affordances
Why use stable planes?

A. Affordance labelling on CAD models

Stable planes
Picture of the tool

B. Classifiers

Evaluation of different classifiers for one or two affordances.

IV. OBJECT RECOGNITION

Evaluation of different descriptors

V. DETECTING HIDDEN AND NON-HIDDEN AFFORDANCES

Explain how once the pose is retrieved from the object recognition module, how the stable pose is found if any.

VI. EVALUATION

Evaluation of the whole process.

VII. CONCLUSIONS AND FUTURE WORKS

A. Conclusions

B. Future Works

VIII. ACKNOWLEDGMENTS

The authors gratefully acknowledge the contribution of National Research Organization and reviewers' comments.

References are important to the reader; therefore, each citation must be complete and correct. If at all possible, references should be commonly available publications.

REFERENCES

[1] J.G.F. Francis, The QR Transformation I, *Comput. J.*, vol. 4, 1961, pp 265-271.

[2] H. Kwakernaak and R. Sivan, *Modern Signals and Systems*, Prentice Hall, Englewood Cliffs, NJ; 1991.

[3] D. Boley and R. Maier, "A Parallel QR Algorithm for the Non-Symmetric Eigenvalue Algorithm", *in Third SIAM Conference on Applied Linear Algebra*, Madison, WI, 1988, pp. A20.