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INTERDISCIPLINARY PROJECT

for

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Prior Affordance Understanding with Relational Learning for Safe Human-Robot Interaction

Problem description:

In the domain of autonomous robot control, artificial assistants require to know what actions can be executed on a given set of objects. Such information, defined as object affordances, is usually obtained online by reinforcement or active learning during the execution of actions [1].

However, for safe human-robot interaction, we require the robot to have, from initialization, an understanding of what actions an object can execute, and what actions an object can be subject to.

As hypothesized in preliminary conceptual work [2], the student will implement the necessary data structures and algorithm, making use of Markov Logic Networks [3] relational learning capabilities, for extracting high-confidence ability modality semantic relations (i.e. *X can Y relationship*) from non-figurative texts, by analyzing co-occurrence of grammatical instances of subjects and verbs, and verbs and objects.

Tasks:

- Study introductory literature regarding the initial concept & grammar features [2], and the learning framework [3].
- Formulate and implement the ability modality semantic relation extraction system.
- Evaluate the system's results on an appropriate technical corpus, by comparing the obtained passive space affordance values with the 12 object affordance labels in the CAD-120 dataset [4].

Bibliography:

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- [2] N. H. Kirk. Towards Learning Object Affordance Priors from Technical Texts. in *Active Learning in Robotics Workshop, IEEE-RAS International Conference on Humanoid Robots*, 2014.
- [3] M. Richardson, P. Domingos. Markov logic networks. in *Machine learning*, vol. 62, no. 1-2, pp. 107-136, 2006.
- [4] H. S. Koppula, R. Gupta, A. Saxena. Learning human activities and object affordances from rgb-d videos. in *The International Journal of Robotics Research 32.8: 951-970.*, 2013.

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