Incremental learning of affordances using interactive and strategical algorithms

Thesis context

We aim for a robot capable of planning and performing tasks in a real life environment with a limited prior knowledge, by discovering and learning affordances.

- **Problems:** - creating a representation of this real environment from our sensors
  - learning in stochastic, unstructured, high dimensional spaces
- **Approach:** **active exploration** and **long life learning**, in order to learn how to recognize affordances from low level visual features

RB1 robot used during tests

Actors

IMT Atlantique
Bretagne-Pays de la Loire
École Mines-Télécom

Lab-STICC

Authors

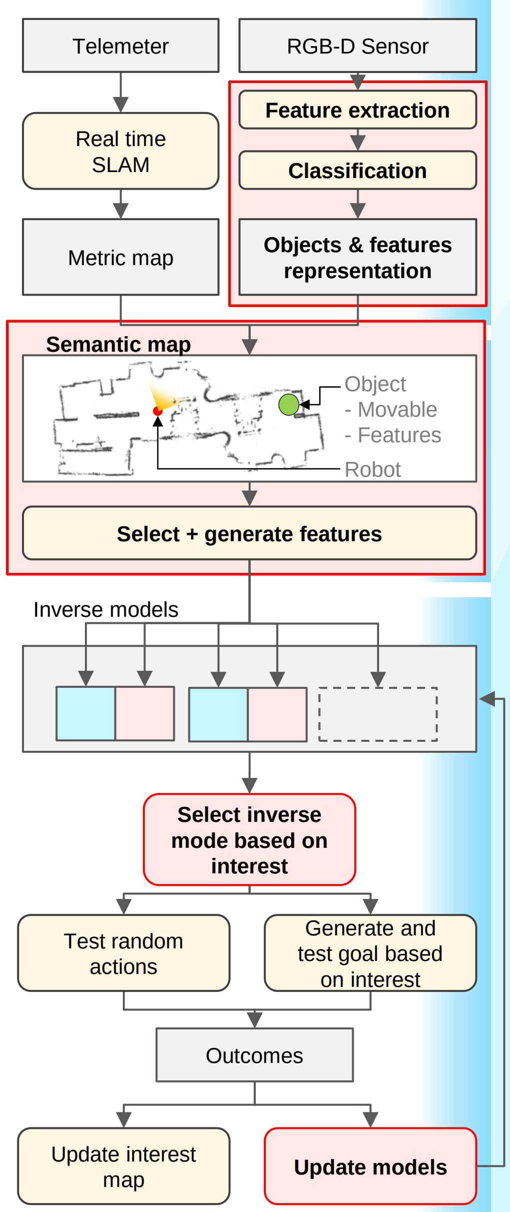
Alexandre Manoury

Thesis supervisor:
Mai Nguyen

Thesis director:
Cédric Buche

Architecture

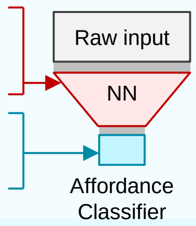
Contributions are marked in red



Visual Extraction

We extract visual features to learn to correlate them with affordances

- **Feature extraction** using a fixed pre trained neural network to segmentate objects and extract their features
- **Affordance classification** using the previously extracted features through a classifier neural network



Semantic Map

- Combines **metrics**, **features**, **location**, and **affordances** of objects
- **Generate additional features**: collision features, relative position, …

Learning

Using **Goal babbling** and **Social interaction** *(based on SGIM-ACTS)*

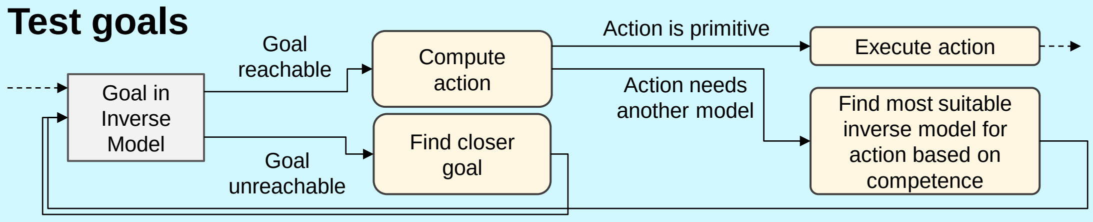
- **Inverse Models** link features and actions (Outcomes → Actions)

  They can be shared across all objects with a given **affordance**
- Update **interest map** based on competence gain or loss

Contributions:

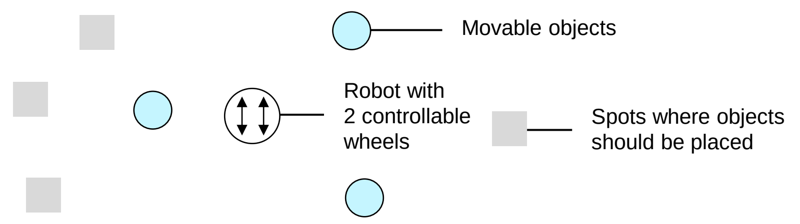
- **Dynamic modelization** updates models depending on the correlation between actions and outcomes
- **Hierarchy** and **planning** are used to reduce the exploration complexity

Test goals



Experiment

- 2D test of the **hierarchy** and **planning** of dynamic models

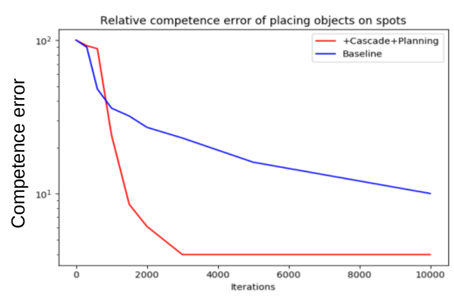


Conclusions

- **Hierarchical representation** and **planning** improve learning in high dimensional action and outcome spaces
- **Dynamic models** are able to structure the environment into a hierarchy of inverse models that can be learned

Results

- Comparison with the algorithm baseline



Models are dynamic in our case and given for the baseline algorithm

Future works

- Implement the semantic map mechanism
- Test the **complete algorithm** in simulation and in a real experience

Contact : alexandre.manoury@imt-atlantique.fr

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