

Master Thesis
IDSC-GZ-AC

The logic of temporal resources and planning for embodied agents

Motivation

The mathematical theory of co-design [1] formalizes the optimal allocation of resources for engineering design problems. While this theory is extremely useful for various practical problems ([2]), there are extensions ready to be developed. In particular, this thesis focuses on the temporal dimension of resources, and formalizes it through linear logic [4] and co-design. As case study we will use the game Minecraft or another similar resource-managing game.

Task

This thesis aims to further develop the work presented in [1], by formalizing the temporal dimension of resources.

During the thesis, you will:

- Learn about **linear logic**, **co-design**, and some category theory [4].
- Formalize the resource logic of Minecraft (or similar game) in the “timeless” setting of linear-logic and co-design.
- Extend linear logic and co-design to account for the time dimensions (“it takes 1 hour for the cake to be baked”).
- Based on the theory, design a task and motion planner for an embodied agent that plays Minecraft, showing that the theory you developed allows you to create the most efficient “resource-conscious” plans.

Skills Required

Affinity for programming (Python), mathematics, optimization.

Contact: Use the link <http://bit.ly/frazzoli-apply> to apply.

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References

- [1] A. Censi, “[A Mathematical Theory of Co-Design](#)”, 2015.
[2] G. Zardini, N. Lanzetti, M. Salazar, A. Censi, E. Frazzoli, and M. Pavone, “[On of AV-Enabled Mobility Systems](#)”, 2020.
[3] D. Crouch, J. V. Genabith, “[Linear Logic for Linguists](#)”, 2000
[4] B. Fong, D. I. Spivak, “[Seven Sketches in Compositionality: An invitation to applied category theory](#)”, 2018

To Apply:

