COHERENT:
COLLABORATIVE HIERARCHICAL ROBOTIC EXPLANATIONS

CSIC (Spain), KCL (UK) and UNINA (Italy)

Chistera Seminar 2021
Robotic systems consist of several processes interacting with each other to accomplish a task.

Relevant explanations may come from the such subsystems at different layers:
- Deep learning perception tools
- Decision-making tools
- Machine learning-based motions

Combine into an coherent explanation
PROPOSAL

- **Hierarchical Explanation Framework**: to combine the information from the different levels
- Delivered **during execution** for true collaboration
- For user acceptance, explanations need to consider **user preferences** and **contextual information**.
- Definition of **measures** to evaluate the **effectiveness** of an explanation.
OBJECTIVES

- Hierarchical Explanation Components (HEC): how to store and retrieve information.
- Explainability along the execution (EAE): what to explain and when.
- Benchmark for HRI: metrics for acceptance and effectiveness of explanations tailored for assistive robotic tasks
USE CASE: ASSISTIVE CLOTH MANIPULATION TASK

- Task with **impact in industry**
  - Clothing industry: inverse logistics and stores
  - Health care: logistics in hospitals and retirement homes.
  - Assistive robotics in general.
- Task with **enough complexity**
  - Bimanual grasps, environmental constraints, several steps
  - Requires to **reason** about manipulation **decisions**
- Utilize CSIC previous experience on cloth manipulation
HIERARCHICAL EXPLANATION FRAMEWORK

- Novel representation of a task as a graph of transitions between scene states.
- Common representation to drive each layer explanation, facilitating the cohesion and the assembly of a coherent message.
EXPECTED PROJECT OUTCOMES & IMPACT

- **Standard framework** to
  - **Combine** explanations of different natures.
  - Provide explanations **along execution**.
- **A set of measures** to evaluate the **effectiveness** of explanations, together with a **benchmark of tasks**.
- **Dataset**:  
  - Labeled video data (used to learn the Cohesion Graph).
  - Collected data during the pilot study.
- The **Cohesion Graph**: A data structure to encode a manipulation task. To close the gap between  
  - High level planning, semantics and explainability.
  - Low-level trajectories and execution controllers.
PROJECT PLAN AND ORGANIZATION

CSIC - Spain
PI & Coord.: Júlia Borràs

KCL - UK
PI: Andrew Coles

UNINA - Italy
PI: Silvia Rossi

- Started April 1st, 2021 – 3 year project

Cohesion graph  Timing, synthesis, communication, metrics...  Pilot study
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