Proposer

Institution / Initiative	ANR, with inputs from the CHIST-ERA projects seminar in Bern
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Topic definition

Topic title *(2-10 words)*	Object recognition and manipulation by robots: Data sharing and reproducible experiments
Short description *(max ½ page)*	The ability of recognising objects and manipulating them is central to robotics. Robots should for example be able to recognise objects mentioned by a user and fetch them, or to visually determine if and how an object can be safely grasped. However, despite decades of research, such abilities remain limited in practice. Limiting factors are the lack of large data sets for training robust models for the tasks under study and of objective evaluation protocols to test these models in a reproducible way. A new approach is needed, going beyond the organisation of robotics competitions, whereby robotic perceptions about the surrounding environment and internal states are recorded, annotated with reference information usable to evaluate models, and shared across researchers working on the same task.
Application sectors	Industrial and service robotics
Keywords	Robotics, object recognition, image recognition, artificial vision, visual servoing, grasping, object manipulation, perception through interaction, embodied cognition, machine learning, benchmarking, performance evaluation, experiment reproducibility

Scientific interest and innovation potential of topic

Describe the state-of-the-art, missing science, and expected outcomes (max 1/2 page).

Comment on all items below:

- *Describe how the topic can support the exploration of bold ideas for radically new technologies based on high-risk / high gain cutting-edge science*

The problem of object recognition and manipulation is far from being solved. Furthermore, objective performance evaluation is not yet really used in robotics, and tasks are seldom defined in a quantitatively measurable and reproducible way. However, the community is ripe for such objective and reproducible experiment practices: The need is clearly expressed from within the community. The topic fosters a much needed change in methodology in a domain which is ripe for it and would trigger a new momentum for progress in a domain of strategic importance.

- *Describe how knowledge and communities from different disciplines can be brought together*

The topic is about combining the traditional robotics research with the objective evaluation methodology developed in the neighbouring field of multimedia information processing and more generally often used in machine learning. The introduction of objective evaluation is highly transformative, by focusing efforts on well defined tasks and by enabling accumulation of clear and sure knowledge, as proven already in the neighbouring domains which have adopted this methodology.

- *Describe how scientific and technological performance can be objectively measured in the area (measurement methods, metrics, tools, infrastructures, …)*

By construction, a major goal of the topic is to make goals clear and progress measurable. Within the field of robotics, the topic of object recognition and manipulation lends itself to objective evaluation. Examples of measurable tasks include fetching an object mentioned by the user and fetching all graspable objects in a given space. Examples of related and measurable sub-tasks are the visual recognition of objects in a scene, the visual estimation of the size of an object, and the characterisation of the properties of an object from physical interaction with it.

- *Describe how research results can be transformed into innovations with societal or economic impact*

The potential impact is huge, by accelerating very significantly the developments in the field of robotics through a change in methodology. Experience from neighbouring fields show that most researchers who experience this new methodology once adopt it and spread it, so the impact would be amplified through the ability of this call to also enhance the efficiency of other research programmes in robotics.

Suitability of topic for a CHIST-ERA call

Describe the need for transnational cooperation, complementarity with existing calls, and suitability of topic size (max 1/2 page).

Comment on all items below:

- *Describe how transnational cooperation in the framework of a joint call can bring added value (complementary national scientific strengths, need for critical mass, need for joint infrastructures, …)*

Transnational cooperation is needed to gather the teams working on the same task around common data sets and benchmarks. Besides, implementing the projects at the CHIST-ERA level can significantly increase the visibility and adoption of the methodology.

- *Describe closest calls (EIC Pathfinder, Horizon Europe, H2020, ERA-NETs, …) and how the topic complements and/or leverages them (the topic should not be redundant with other calls)*

While robotics is significantly covered in H2020 (in the LEIT ICT part), benchmarking is not embedded in the research projects.

- *Describe how a significant contribution in the area can be obtained with a call of a few M€, possibly giving indications about the size of the main events, initiatives or structures in the area (conferences, programmes, teams, centres, professional associations, …)*

The topic can have a significant impact since there is currently almost no reproducible evaluation and a few projects would be enough to trigger a significant change.