



**chist-era**



# CHIST-ERA Projects Seminar 2022

**Object recognition and manipulation by robots:  
Data sharing and experiment reproducibility  
(ORMR)**

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## Object Recognition and Manipulation in Robotics (ORMR)

[EU CHIST-ERA programme](#)

EU CHIST-ERA Research projects

[BURG](#) [CORSMAL](#) [IPALM](#) [InDex](#) [HEAP](#) [Learn-Real](#) [PEGROGAM](#)

**PeGRoGaM** Perception-guided robust, reproducible robotic grasping & manipulation

**InDex** Robot In-hand Dexterous manipulation by extracting data from human manipulation of objects to improve robotic autonomy and dexterity

**IPALM** Interactive Perception-Action-Learning for Modelling

**HEAP** Human-Guided Learning and Benchmarking of Robotic Heap Sorting

**BURG** Benchmarks for UndeRstanding Grasping

**LEARN-REAL** Learning physical manipulation skills with simulators using realistic variations

**CORSMAL** Collaborative Object Recognition, Shared Manipulation and Learning

# Major Achievements and Outputs

- ❖ **Novel methods** for interactive scene manipulation, object classification, grasping, human-in-the loop-learning
- ❖ Investigated
  - the roles of **variations in sim-to-real learning** challenges
  - individual components for object/scene modeling developed in various settings into a system working with **hardware** and **real scene**
- ❖ **Tools** to create synthetic data and annotate real data
- ❖ Sharing **object datasets + manipulation datasets**, with annotations
  - objects with poses, grasps (incl. grasp score), object parts, task relevance
  - images, videos, sound files, tactile sensors data
- ❖ Sharing **baselines**, pre-trained **models**, benchmarking **protocols**
- ❖ Organisation of **four Challenges**
- ❖ **Engagement** with external researchers who use ORMR data and models, publish using ORMR data, and, in turn, share their models and annotation

# Upcoming Challenges and Needs

- ❖ Engagement with the community after the **project ends**
- ❖ Uptake by **industry**  
especially nuclear, recycling, logistics, manufacturing (which are perceived as conservative)
- ❖ **Benchmarks** accounting for different types of variations + involvement of humans
- ❖ **Standardisation** of representations + interfaces
  - **reproducible setups** & **dataset integration**: documentation + maintenance beyond project
  - **combining** learning modalities (orchestrating learning by interaction and self-refinement)
  - **integration** and engineering effort not (yet ...) available in academia
- ❖ **Robustness** to uncertain conditions
- ❖ **Fusion** of audio, visual, and tactile sensing
- ❖ **Adaptation** of the pre-trained models across labs and conditions



# Possible Roadmap

- ❖ **Long-term availability** of website and GitHub
  - **hosting** of links to ORMR **datasets** in a dedicated CHIST-ERA webpage
  - **exploitation** of **datasets** created in related projects
  - **continue building** (and help others build) upon our **data** and **models** beyond projects
- ❖ **Joint initiative of ORMR** consortia to push the field towards specific goals
  - consortium of selected consortia or selected partners across consortia to maintain momentum?

# Role of the CHIST-ERA Support

- ❖ CHIST-ERA has already helped and/or can help
  - increasing **dissemination of projects outcomes** through Twitter and LinkedIn
  - organising **calls** on topics with great potential if the collaboration between projects/sharing and collating outputs can be realised
  - fostering **cross-project expertise** with calls-for-projects targeting specific topics
  - allowing multiple international partners (>2) to collaborate (in contrast to bilateral research programs)
- ❖ Some projects need support for
  - encouraging Spanish and Italian funders to finalise funding schedules (overall project output relies upon components from partners)

## ❖ Ethics

- researchers informed about ethical implications at the institutional level
- approvals required for all studies involving human participants
- transnational hosting and attribution of large datasets

## ❖ Gender equality

- some projects close to 50/50 (PIs & Co-Is), however more efforts are needed to realise gender equality among researchers
- more effort to make science open/accessible/understandable to teens/young people when they make their first career decisions
- to consider whether the developed methods affect different genders differently

## ❖ Governance

- university-led initiatives to embed Responsible Research and Innovation practices
- to follow e.g. EPSRC AREA framework and ORBIT practices



## ❖ Open Access

- datasets, tools etc. available as open source (e.g. Zenodo) for hosting and long-term sustainability (DOIs) [CORSMAL]
- institution support for open access publishing due to funder requirements [HEAP]
- additional support from SNSF for gold open access publishing [LEARN-REAL]

## ❖ Public Engagement

- industry talks, workshops, research open days
- IET Children's Lecture [CORSMAL]
- workshops for Children towards STEM [BURG]
- Science in the Park, Cobot Maker Space events [HEAP]

## ❖ Science Education

- integration of benchmark tools/datasets into curricula
- training of PhD and MSc students [CORSMAL+LEARN-REAL]

## ❖ Open data and software sharing

- datasets, annotations and software as open source
- DOIs for datasets (e.g. via zenodo)
- baselines, pre-trained machine learning models, evaluation toolkits

## ❖ Challenges

- understandable, easy-to-reuse/reproduce software
- clear metadata and documentation accompanying datasets and codes



# Technology Transfer

## ❖ Often realised by

- academic start-ups acquired by large companies
- joint industry/academia positions
- companies directly hiring experts who are trained within projects
  - more cost effective and legally easier
  - researcher (CORSMAL) who contributed to the baseline hired by Medtronic

## ❖ Potentials

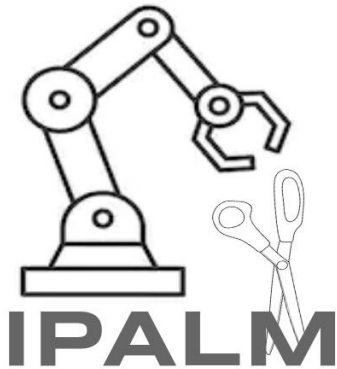
- industrial interest for bin picking  
(different types of objects from in-class variation to transparent)

## ❖ Challenges

- some industries are sceptical about open-source tools (ROS) & favour closed architectures
- strong focus on verification/validation before any new technology can be deployed

# Thank you!

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HEAP

PeGRoGAM

InDex



CORSMAL

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shared manipulation and learning

*Learn-Real*