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Harmony

Assistive robots for healthcare

Enhancing Healthcare with Assistive Robotic Mobile Manipulation

(HARMONY) | H2020-ICT-2018-20| RIA

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Revision History

Version	Date	Author(s)	Comments
0.1	18.05.2021	Jen Jen Chung	First draft
0.2	20.05.2021	Lionel Ott, Jen Jen Chung	First internal revision
1.0	25.05.2021	Lionel Ott, Jen Jen Chung	Second draft for consortium circulation
2.0	15.06.2021	Jen Jen Chung, Bob Schadenberg	Incorporating UT suggestions
3.0	24.06.2021	Jen Jen Chung, Paulo Alvito	Incorporating IDM suggestions

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Summary

This deliverable outlines the Harmony data management plan following the template supplied by the European Commission for Horizon 2020 projects. The document describes the types of data that will be collected, processed and generated during the project, and which data will be made open access. The document outlines how data will be managed and stored to ensure that it is findable, accessible, interoperable and reusable (FAIR). We also highlight ethical concerns regarding potential requirements for data anonymisation.

1. Data summary

The project Harmony emcompasses six main technical objectives:

1. Perception: Formalise an object-based world representation
2. Localisation: Develop robotic localisation and mapping for an object-based environment
3. Planning: Provide adaptive, congestion-free motion plans in human-centred spaces
4. Grasping: Learning grasping and manipulation from demonstration via an immersive control interface
5. Control: Develop robust and compliant whole-body motion planning and control for interacting with unknown objects
6. Human-robot interaction: Deliver safety and acceptability recommendations for the use of mobile manipulators in human-centred environments

The achievement of these objectives requires the collection and generation of robot data as well as human user data. Robot data will consist of recordings from various onboard sensors such as colour and depth cameras, 2D LiDAR and wheel odometry. These data will be collected from mobile robots moving in indoor human environments such as an office, lab or hospital and may include people in the datasets. Robot data will primarily be used to iteratively evaluate performance metrics related to the first five technical objectives. Human user data will consist of recorded object manipulation demonstrations to train our robot grasping and manipulation algorithms (objective four). In addition, responses from user studies will also be used to assess the long-term utility, acceptability and expectations indicated by users regarding the use of the robot over time (objectives four and six).

1.1. Data types

Harmony will be developing software in the ROS framework (ROS 2 version). Thus, robot data will be recorded in the form of rosbags using standard ROS message types [1]. Data recorded in this form includes standard header information (timestamp and frame ID) and can be played back post hoc for further offline developments and evaluations. This is of particular importance for work towards objectives one and two, which can also leverage existing robot navigation [2] and scene reconstruction [3–6] datasets but will require algorithm refinement and evaluation in our target Harmony use cases.

The recorded data will primarily contain sensor readings but will also include certain artefacts produced by methods that act as inputs for other components of the project. Given the number of sensors and the types of data that will be collected, which include raw sensor data (images, point clouds, high frequency odometry, manipulator state) and generated artefacts (scene segmentations, object reconstructions), a large amount of data is expected to be generated per recording, in the order of gigabytes per few minutes of operation, even after data compression. In addition, human annotations, such as labelling objects and object relationships, may also be included in a post-processing step to provide additional ground truth benchmarking utility. Furthermore, for the user studies, we will need to make and store

video and audio recordings of the participants interacting with the robot, questionnaires, and interviews with the participants. The resulting datasets of the user studies will also be stored and shared when possible.

1.2. Data utility

Robot sensor data collected from indoor scenes will be helpful to other computer vision and robotics researchers investigating topics related to object-based map representations and 3D scene understanding. The inclusion of derived data enables the comparison of results and provides a starting point for researchers interested in higher-level tasks that build on top of processed data. In particular, human-annotated datasets are especially valuable to the research community as they provide ground-truth information and allow for cross-platform comparisons and benchmarking.

Sharing the datasets from the studies will allow others to replicate and verify our work. Furthermore, it allows other researchers to test new hypotheses, or use new methods to analyse our data. To what extent we can share the datasets will depend on the type of data that is collected, and whether participants gave their informed consent to their data being shared.

2. FAIR data

2.1. Making data findable, including provisions for metadata

All data collected and/or generated for use within the project will be stored by the partner who collected/generated it on data sharing platforms such as Polybox or Surfdrive, which adhere to EU legislation. Each dataset should be compressed to a single file along with a readme file providing an overview of the data contained within and usage instructions. Files should be given an appropriately descriptive name suffixed by the name of the partner who generated the data and the date of collection, e.g., cluttered_tabletop_ethz_20210520.bag.

2.2. Making data openly accessible

We intend to open source the Harmony perception and grasping data, which we believe will provide substantial value to the robotics and computer vision community. Note that these datasets may include personally identifiable data (e.g., camera images of people). As such, we will consult with our ethics and safety advisory board (ESAB) as well as our local institutional ethics committees to obtain the appropriate approvals and conduct data anonymisation if needed prior to open-sourcing the data.

Open-sourced datasets will be stored in online archival collections such as the ETH Research Collection [7] or OpenAIRE [8], which provide digital object identifiers for all entries. We will also provide links to the datasets through the Harmony website as well as through the communication channels of the individual partner(s) responsible for the data. When the dataset is linked to a publication, the link to the dataset is then also made known at the publisher and/or enclosed in the publication itself.

The data will be stored primarily as rosbags, allowing users to access the data via ROS or ROS2, a standard open-source framework in the robotics community. In addition, we also intend to open-source various software modules developed within Harmony. Software that makes use of any open-source datasets will also be linked appropriately as examples of how to parse and use the data. The usage of rosbags ensures that the data is usable even if some generating software is not open-sourced.

2.3. Making data interoperable

As mentioned above, robot data collected and generated in Harmony will be stored in the rosbag format using standard ROS message types. This allows interoperability between all users of ROS and ROS2, which is widely used in the robotics research community. The datasets from user studies will be accompanied by a readme file which will explain each of the variables from the dataset.

2.4. Increase data re-use (through clarifying licences)

Open-sourced datasets will be licensed to permit the widest reuse possible while remaining in line with the Harmony Consortium Agreement (CA) regarding the dissemination and exploitation of project outcomes. In particular, in accordance with the CA 8.2 Joint ownership and CA 8.4.2 Dissemination of own Results, an embargo period of 45 calendar days or 25 calendar days, respectively, will apply to allow consortium partners to raise objections to publishing the data. There may be cases where data cannot be made public due to intellectual property rights, mainly from industrial partners. These cases will be identified during the above-mentioned embargo period. Wherever possible, we will aim to license the published data under open licenses, such as Creative Commons [9], where possible to maximize the ability to reuse the data. Once published, the data will remain open and available on the chosen archival platform (e.g., OpenAIRE).

3. Allocation of resources

There are no foreseen additional costs for making data FAIR in Harmony. The project coordinators (ETHZ) will be responsible for managing the data. Long term preservation of the data will be provided by the chosen archival platform (e.g., OpenAIRE).

4. Data security

As mentioned previously, Harmony partners will make use of institutional cloud storage and data sharing services. These platforms are certified (e.g., ISO 27001) and satisfy EU and national data protection legislation, ensuring the integrity of the data and their safety. Open-sourced data will make use of certified repositories such as OpenAIRE for long term preservation and curation.

5. Ethical aspects

As discussed in Section 2.2, personally identifiable information may be collected as part of Harmony studies. In such cases, we will consult with our ESAB and local ethics committees prior to data collection regarding the requirements for data anonymisation. Informed consent for data sharing and long-term preservation (at least 10 years) is included in questionnaires dealing with personal data. Particular attention will be paid when collecting data intended for public dissemination. See Harmony deliverable D11.1.

Conclusions

In summary, our data management plan aims to store data generated during the project in a widely accessible format in the robotics community and make it available, where possible, under a permissive license on publicly accessible data-sharing platforms. To address any ethical issues arising from the involvement of humans will be handled by consulting our ethics and safety advisory board as well as our local institutional ethics committees.

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