21ENGBIO GRABILITY: Bioinspired Grasping for Improved Stability in Walking Robots

A Data Management Plan created using DMPonline

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Project abstract:

This project will developed a bioinspired grasping lower limb for augmented stability in legged robotics. Bioinspiration comes from the perching mechanics of birds during landings and take offs. The project includes development of a novel instrumented perching rig to measure ground force and torque reaction data, that will inform the the design constraints of bioinspired grasping robotic limbs.

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Manchester Data Management Outline

1. Will this project be reviewed by any of the following bodies (please select all that apply)?

- Funder

2. Is The University of Manchester collaborating with other institutions on this project?

- Yes - Part of a collaboration and owning or handling data

Working with collaborators (Co-I and technician) at Bangor University.

3. What data will you use in this project (please select all that apply)?

- Acquire new data

Acquiring new experimental data on avian ground force and torque reaction, and avian kinematics. Synthesizing new data from simulations on robotic dynamics.

4. Where will the data be stored and backed-up during the project lifetime?

- University of Manchester Research Data Storage Service (Isilon)

During the experiments data will be saved to local hard drive and backed up to Dropbox for Business. Within 2 weeks of each experiment the data will be transferred to University of Manchester Research Data Storage.
Simulation data will be saved to local hard drive and backed up to Dropbox for Business.

5. If you will be using Research Data Storage, how much storage will you require?

- < 1 TB

Previous experience of similar flight tests indicate that <1TB of data will be sufficient for video data and force-torque sensor data

6. Are you going to be receiving data from, or sharing data with an external third party?

- No

All data will be retained between the two collaborating Universities.

7. How long do you intend to keep your data for after the end of your project (in years)?

- 5 - 10 years

Data will be used in writing journal publications, and a follow-on proposal on a similar topic that, if successful, will utilise this data set over the next 5-7 years.

Guidance for questions 8 to 13

Highly restricted information defined in the Information security classification, ownership and secure information handling SOP is information that requires enhanced security as unauthorised disclosure could cause significant harm to individuals or to the University and its ambitions in respect of its purpose, vision and values. This could be: information that is subject to export controls; valuable intellectual property; security sensitive material or research in key industrial fields at particular risk of being targeted by foreign states. See more examples of highly restricted information.

Personal information, also known as personal data, relates to identifiable living individuals. Personal data is classed as special category personal data if it includes any of the following types of information about an identifiable living individual: racial or ethnic origin; political opinions; religious or similar philosophical beliefs; trade union membership; genetic data; biometric data; health data; sexual life; sexual orientation.

Please note that in line with data protection law (the UK General Data Protection Regulation and Data Protection Act 2018), personal information should only be stored in an identifiable form for as long as is necessary for the project; it should be pseudonymised (partially de-identified) and/or anonymised (completely de—identified) as soon as practically possible. You must obtain the appropriate ethical approval in order to use identifiable personal data.

8. What type of information will you be processing (please select all that apply)?

- No confidential or personal data

9. How do you plan to store, protect and ensure confidentiality of any highly restricted data or personal data (please select all that apply)?

- Not applicable

10. If you are storing personal information (including contact details) will you need to keep it beyond the end of the project?

- Not applicable

11. Will the participants' information (personal and/or sensitive) be shared with or accessed by anyone outside of the University of Manchester?

- Not applicable

12. If you will be sharing personal information outside of the University of Manchester will the individual or organisation you are sharing with be outside the EEA?

- Not applicable

13. Are you planning to use the personal information for future purposes such as research?

- No

14. Will this project use innovative technologies to collect or process data?

- No

15. Who will act as the data custodian for this study, and so be responsible for the information involved?

Ben Parslew

16. Please provide the date on which this plan was last reviewed (dd/mm/yyyy).

2021-08-07

Data areas and data types

Outline the volume, type and content of data that will be generated e.g. experimental measurements, models, records and images

Experimental measurements of avian ground force and torque will be recorded. The data will be stored as .CSV format. The volume is predicted to be <5Gb

High speed video data of avian kinematics will be recorded, and stored as .mp4 format. The volume is predicted to be <200Gb

Photographs of the experimental rig setup will be stored as .jpeg or .png files, and will be <1Gb.

Generated simulation data of robot dynamics from Matlab/Simulink models will be stored as files and also as .CSV files to be shareable with the scientific community, <5Gb.

All data will be safely stored on open, non-proprietary formats used within the scientific community.

Standards and metadata

Outline the standards and methodologies that will be adopted for data collection and management, and why these have been selected

Simulation data from Matlab/Simulink models of robotic dynamics will be collected by Ben Parslew (PI) in accordance with standard multibody simulation methods used in the literature, including those used by Ben in previous publications on avian jumping dynamics. Metadata will be added to define all variables and simulation parameters within the data.

Experimental measurements will be managed by Kristen Crandell (Co-I) using standard methods in biomechanics literature for animal flight testing and data capture including those she has developed and applied previously in experiments on perching diamond doves (Geopelia cuneata)

Digital force-sensor and video data will be recorded live during the experiments to local hard drive, and backed up to Dropbox for Business. Data will be uploaded to University of

Manchester Research Data storage (Isilon) within 2 weeks of conducting each experiment.
Metadata will be employed to describe the raw experimental data
These methods are selected for their alignment with standards used in the research field.

Relationship to other data

State the relationship to other data available in public repositories

Previous data on parrotlet grasping force and torque, and kinematics during perched landings and take-off exists in scientific literature [Roderick et al 2019] and are available online at https://doi.org/10.5061/dryad.89rr53h. Force and torque data, along with extracted kinematic data from videos in the current study will be processed in the same formats as [Roderick et al 2019], and when published will be shared in figshare/Dryad online repositories, to complement the previous work in this field.

Secondary Use

Outline the further intended and/or foreseeable research uses for the completed dataset(s)

Foreseeable research use for the datasets includes supporting future biomechanics research on grasping animals (birds and others). The dataset will also also support mechanical engineering and robotics design research, with particular use in defining actuator torque and power limits for future grasping foot designs.

Methods for data sharing

Outline the planned mechanisms for making these data available, e.g. through deposition in existing public databases or on request, including access mechanisms where appropriate

Simulation and force-torque and extracted kinematic experimental data will be made available through Dryad/Figshare online repositories and referenced in open access academic publications (target journal- Journal of the Royal Society Interface). The data will also be assed directly to publications as supplementary data.
Complete high speed video data of all trials will be made available on request through a

Dropbox for Business link. All publications will mention that the video data is available for request, and contact details provided.

Proprietary data

Outline any restrictions on data sharing due to the need to protect proprietary or patentable data

Experimental biomechanics data will have no restrictions on data sharing to protect proprietary of patentable data.

In the event that the robotic simulation data data shows potential for commercialisation/IP, guidance will be sought from the University of Manchester Innovation Factor on established whether any simulated data should be withheld.

Timeframes

State the timescales for public release of data

Experimental biomechanical data will be submitted for publication to a scientific journal within 1 year of the end date of the project, and uploaded to FigShare/Dryad for public access on acceptance to the journal.

Should IP protection by patenting be pursued for robotic simulation data, data will be made public after patent application

Formats

State the format of the final dataset

Force-torque sensor data and extracted kinematic data will be .csv format

Raw video data will be .mp4 format

Simulation model data will be .csv format

Photographic data of the experimental setup will be .jpeg/.png formats.