3D digitisation pilots for insect collections

Call for proposals and specification of work

Aims and background

The work entails building prototypes for demonstrating automatic digitisation of large numbers of pinned insects in museum collections.

New innovations are needed to speed up digitisation of insect collections. Insects constitute more than one half of all specimens in natural history collections, meaning hundreds of millions of objects in Europe.

Digitisation here means taking photograph(s) of the actual insect specimen and the labels and any preparations attached to the pin, which holds the specimen. Currently the fastest available systems can process up to 500 specimens in a working day (c.f., Tegelberg et al 2014). We are looking for innovative solutions that have the potential to perform 10 times faster than this.

- Tegelberg R, Kahanpää J, Karppinen J, Mononen T, Wu Z, Saarenmaa H (2017) Mass digitization of individual pinned insects using conveyor-driven imaging. In: Hereld M (Editor) High throughput digitization for natural history collections. 2017 IEEE 13th International Conference on e-Science (e-Science 2017). Auckland, New Zealand, 24-27 October 2017. 5 p. DOI:10.1109/eScience.2017.85. (NB: This article cannot be downloaded freely — contact us to get a copy.)

This work belongs to the project ICEDIG (Innovation and Consolidation for Large-Scale Digitisation of Natural Heritage) https://icedig.eu/. ICEDIG is a design study for the new DiSSCo Research Infrastructure http://dissco.eu/ (Distributed System of Scientific Collections). ICEDIG is being funded by the Horizon 2020 Framework Programme of the European Union programme H2020-INFRADEV-2016-2017, as Grant Agreement No. 777483. Coordinator of ICEDIG is the University of Helsinki that will be awarding the contract(s) for this study.

Description of the Work from ICEDIG project plan specifies the *Subtask 3.1.2:* ***Mass-imaging of pinned insects*** as follows: *Mass-digitisation of pinned insects has only been achieved in some pilot projects until now. We will investigate what it will take to scale up available techniques and new technologies for processing thousands of specimens per day in one facility. Various approaches such as conveyor belt-driven automatic imaging, cameras attached to robotic hands, and multispectral imaging will be explored, and when needed, piloted with the assistance of subcontractors who know important new technologies.*

Specifics

The ICEDIG project has scoped possible solutions and produced a Milestone Document MS11 describing six possible experiments, which all are based on some 3D imaging techniques. We are looking for two separate contractors (for Lots 1 and 2 described below) to build prototypes of two of the six experiments. Also other experiments potentially achieving the above stated goals can be considered, if well justified. The MS11 document is available for download on the ICEDIG website (News section) at https://icedig.eu/news

Lot 1. A multispectral imaging pilot project should explore teraherz time-gated spectral imaging or other technologies that can penetrate through insect wings and the labels on the pin (i.e., layers of

paper). This will be used to see if densely stacked labels in pinned insects can be read without removing them from the specimen. The approach should have the potential to process a large number of specimens in an automated environment.

Lot 2. A robotics pilot project requires placing cameras in robot hands, rails, or other moving equipment, and then automatically taking large number of images of the pinned insect specimens. These images need to be then automatically processed into a 3D model of the specimen(s). Labels underneath of the specimen(s) should become readable when seen from different angles.

Proposals

Proposals should contain the following:

1. Description of the company and/or the research lab and its experience and which is related to the call.
2. Description of the approach and equipment chosen by the proposer. Approximate costs of the equipment and software should be mentioned so that we can assess the economy of the approach.
3. Names and CVs of the people involved in the project (if already known).
4. Timeline of the work, which would need to fit in ICEDIG timetable, meaning that the contract will be made in early December 2018. Final report and demonstration should be delivered in June 2019. Short intermediate reports should be delivered in January 2019 and April 2019.
5. Description of the work environment and communication towards the ICEDIG project. ICEDIG project members should be kept aware of the progress at all times and sought for their advise and input on a regular basis.
6. The available budget for each lot is 20,000 €, and proposals should be sized to fit in this budget, including any equipment which the proposer may need to acquire for the study. Statement of the costs and desired schedule of invoicing should be included. We propose an advance payment of 40% and 20% after each approved report.
7. Statement of IPR. The contractor may retain the copyright of its innovations, but ICEDIG partners will need to have the right to use all code and documentation in their own internal research and digitisation activities, but excluding commercial services. However, Open Source of all material is recommended.

The proposals shall be submitted on email to anne.koivunen@helsinki.fi by 30 November 2018 12:00 EET (UTC+02) (noon).

Members of the ICEDIG Consortium are not eligible to apply.

Evaluation

As the price is fixed, the evaluation is based on quality of the proposal. The following criteria will be used to choose the contractor. Weigh of criterion is 10% unless otherwise stated.

1. Potential of the approach to achieve high-performance imaging of pinned insects and their labels. Minimal handling of the specimens by human operators will be particularly advantageous. Weigh 20%.

2. Planned output of the pilot project, such as demonstration of equipment, software, website, videos, slides, etc. (NB: Periodic report documents are required in any case.) Weigh 20%.
3. Cost of the equipment, software, etc., for later implementation at museums. Low cost per imaging station will be advantageous.
4. Physical set-up demands and safety of the approach for both human operators and the specimens being imaged. Compatibility with the museum environment will be advantageous.
5. Expertise of the staff in photogrammetry, robotics, software programming, and other technologies which will be used. Experience of the staff in working with natural history museums and biological samples will be advantageous.
6. Experience of the contractor with the proposed technology and already available, proven equipment, if possible.
7. Open source of software and open data.
8. Quality and details of the actual proposal, including clear schedules of work, outputs, and communication .

The ICEDIG project retains the right not to award any contracts if the proposals and approaches are not considered sufficient.