EMAC23: Equip MoveApps for Conservation - Coding challenge and App development workshop

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MoveApps, the open-source movement analysis platform of the Max Planck Institute of Animal Behavior, has been named a Conservation Tech Award grantee in 2022! We are proud and honoured, and want to spend the grant awarded by the Allen Institute for AI's (AI2) EarthRanger towards improving MoveApps for the conservation community that has seen so much potential in it. Ultimately, we want to have MoveApps populated with more conservation-focused Apps and empower the community's code developers to develop new Apps. For reaching this goal, we have set up this EMAC23 coding challenge which will be followed by the EMAC23 workshop at our institute in September 2023. Co-funding from the Centre for the Advanced Study of Collective Behaviour (CASCB) allows us to invite a larger number of participants.

We launch the EMAC23 coding challenge on 1 March 2023 and set the deadline to 31 May 2023. See below five use cases that are related to the recently most pressing animal conservation concerns. Select one of the use cases and develop App code that addresses the described task in a creative way, applying it to the one or more of the recommended tracking datasets. Fill in our Registration Form, initialise your App on MoveApps and submit a functioning version via GitHub. For the challenge, please add your last name to the title of the App. The App must be well designed and documented. Although any submitted App must be open source, it will still be owned by the developer after submission. The scope of all submitted Apps is to support conservation with explicit and near real-time results of tracking-based analyses. Note that all Apps must work for more than on track or animal. You can use R, R-Shiny or Python for the development of your App. See our User Manual and use provided GitHub templates. If at any stage of your development, you have problems or questions, do not hesitate to reach out to support@moveapps.org.

After the deadline of the coding challenge (31 May 2023), our international assessment committee will select the 10 best Apps in terms of creativity, code performance, output quality. The developers of those Apps will be invited to join the EMAC23 workshop, held at the Max Planck Institute of Animal Behavior in Germany. Visa, flights and accommodation will be fully taken care of by out grant money (provided by AI2's EarthRanger and CASCB). The one-week workshop will include a detailed tour of the MoveApps platform, its host institute and discussions with system developers. All contributed Apps will be presented, discussed and potential users defined. If applicable, collaborative conservation practitioners will be directly contacted and potentially involved in further development. The implementation of some important adaptations and possibly new App ideas will be pursued in small group projects and with the support of the MoveApps team. An excursion day into the nearby Alps will encourage all participants to get to know each other better and become collaborators for the protection of the earth's wildlife beyond the time of the workshop.

The use cases are based on major animal conservation challenges that we face presently, with a focus on African wildlife. Most everyday problems generate around human-wildlife conflicts and poaching.

1. Detection of stationarity. The most straightforward way of pinpointing poaching activity is to detect if a tag is no longer mobile. That means the tag is moving so little around a central location that it is likely due to the usual location error only. Such inactivity can also indicate tag drop off. Write an App that can efficiently detect from location data like GPS that a tracked animal has been injured, died or shed its tag. This App should be based on location data, as many tags do not record auxiliary data as e.g. acceleration. Help us contribute to retrieve tags and alleviate poaching.

2. Foraging cluster detection. Vultures and other carnivores are under great threat of poisoning. To quickly detect rich feeding sites that can indicate poisoned carcasses, a previously successful strategy has been to follow a collection of tracked vultures and extract sites where they cluster together for a longer time interval. Develop an App that can efficiently extract cluster sites where multiple tracked vultures feed together. A simple clustering workflow is already available on MoveApps, help us to improve its performance by innovative methods.

3. Extraction of movement hotspots or corridors. At all scales there are areas that animals exclusively use for passing though. These may be migration corridors, connections of fragmented habitat or routes to drinking holes. Such corridors or movement hotspots have classically been defined by habitat characteristics. However, more sensibly, they can be identified as those areas where animals move through quickly and in a parallel manner (LaPoint et al. 2013). For the most significant result, tracking data of a collective of animals must be used. Once known, movement hotspots can be used to improve species and ecosystem management and conservation. Help us protect regions that animals need to pass through by writing an innovative App that identifies movement hotspots or corridors from tracking data.

4. Home range estimation. Most animals and animal groups range a defined area in the scale of weeks or months, their so-called home range. To allow rangers on the ground to optimise their search activity and regularly check on sensitive, tagged individual animals, it is helpful to obtain individual and group's combined home ranges that indicate territories, possible preference regions or hotspots of use. Write an App that extracts animals' home ranges from location tracks like GPS with indications of use intensity. If possible, give indications of optimal sites, routes or times for a ranger's patrol.

5. Interaction with human infrastructure. To minimise the constantly growing conflict between humans and wildlife in areas like southern and eastern Africa, interactions of wild animals with human infrastructure like roads, fences or villages have to be quantified. Such could allow the extraction of hotspots of interaction and define possible mitigation measures. Write an App that indicates where tracked animals interact with some type of man-made structure, focus to extract either main sites or times of conflict and related interesting behaviour. Use freely available environmental data like open street map.

Recommended data

For App development and testing, we recommend the use of a selection of previously collected tracks that are openly available on Movebank. We have set up this challenge with a focus on African conservation issues, but tracking data from African wildlife is mostly too sensitive for sharing. See below some suggested datasets from Movebank that should be helpful with regard to the above use cases, but you can also select others or use own data. Note that most datasets on Movebank have been analysed previously for various aspects of ecology and are openly available, but data owners can be approached or become involved during the workshop.

If you have a Movebank account you can download the data (or a subset of a study) using the Movebank App in MoveApps, receiving a moveStack rds-file, which is the most common input type for MoveApps Apps. Alternatively, you can download the data (without Movebank login) as csv-files from www.movebank.org and upload them to MoveApps from your Google Drive or Dropbox account using the Upload File from Cloud Storage App.

1. LifeTrack White Stork SW Germany (Movebank ID 21231406)

2. EuroDeer: Roe deer in Italy 2005-2008 (Movebank ID 9480191)

3. Hebblewhite Alberta-BC Wolves (Movebank ID 209824313)

4. Kruger African Buffalo, GPS tracking, South Africa (Movebank ID 1764627)

5. Martes pennanti LaPoint New York (Movebank ID 6925808)

6. Cathartes aura MPIAB Cuba (Movebank ID 1393954358)

7. Straw-colored fruit bats (Eidolon helvum) in Africa 2009-2014 (Movebank ID 404939825)

8. Movement ecology of the jaguar in the largest floodplain of the world, the Brazilian Pantanal (Movebank ID 19411459)

9. Site fidelity in cougars and coyotes, Utah/Idaho USA (data from Mahoney et al. 2016) (Movebank ID 193545363)

10. North Sea population tracks of greater white-fronted geese 2014-2017 (data from Kölzsch et al. 2019) (Movebank ID 657674643)