Image recognition and artificial intelligence for biological recording

Alba Gomez Segura & Grace Skinner

BRC Conference

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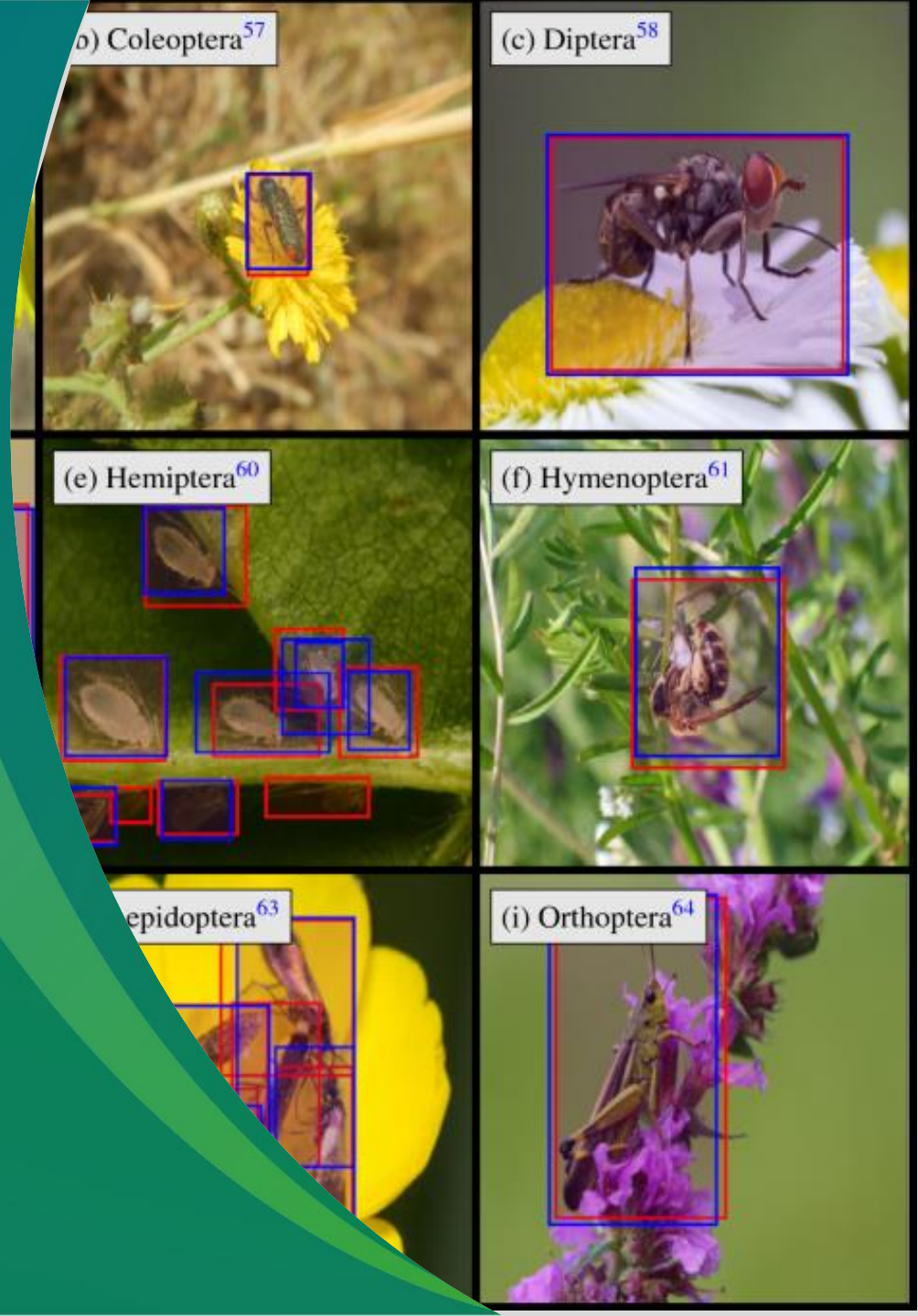

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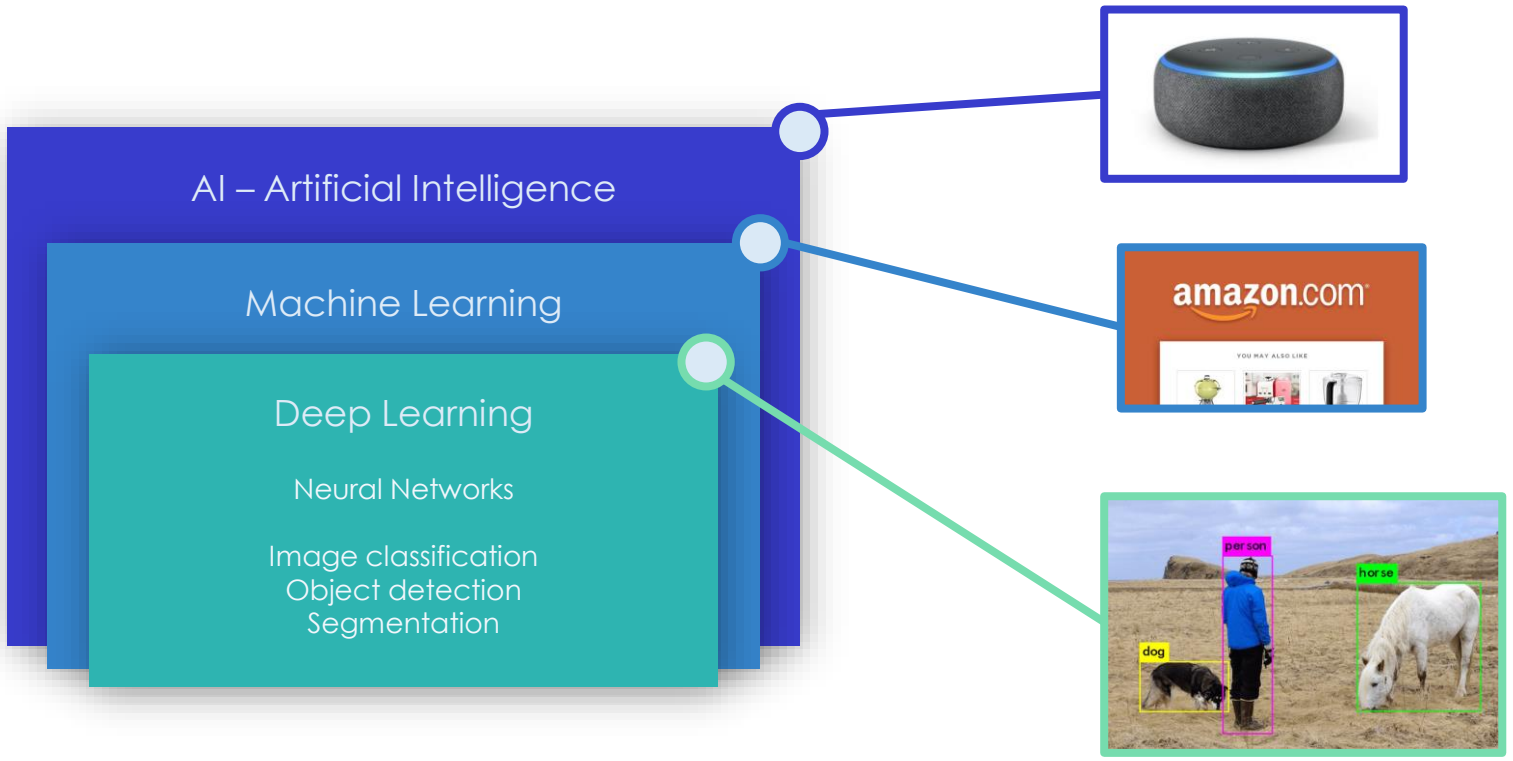
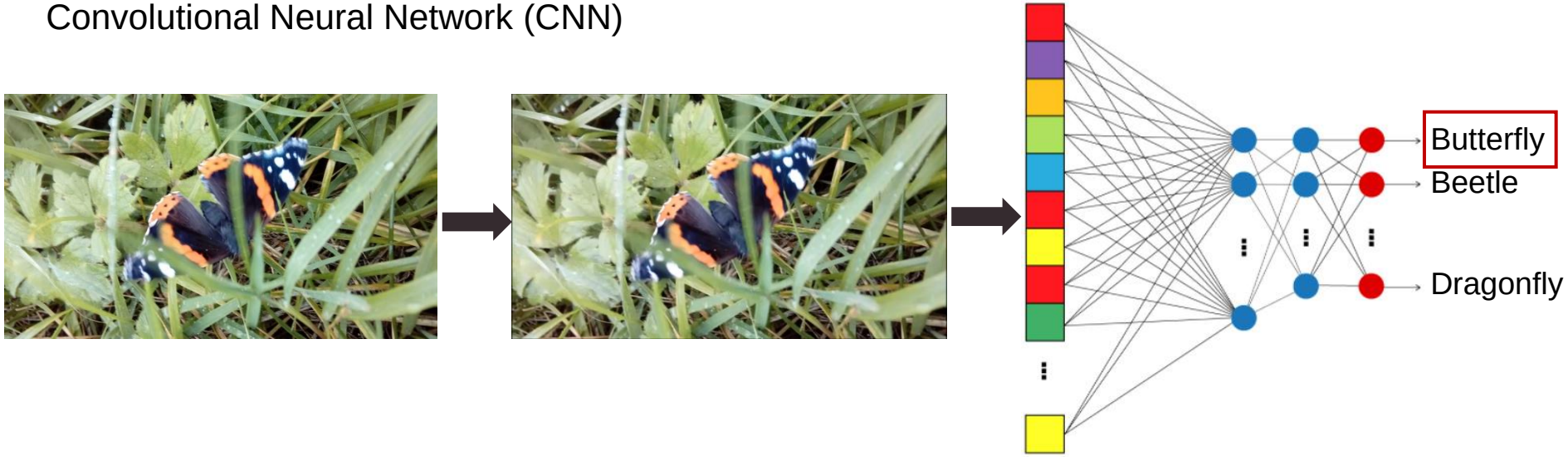
What is Artificial Intelligence?



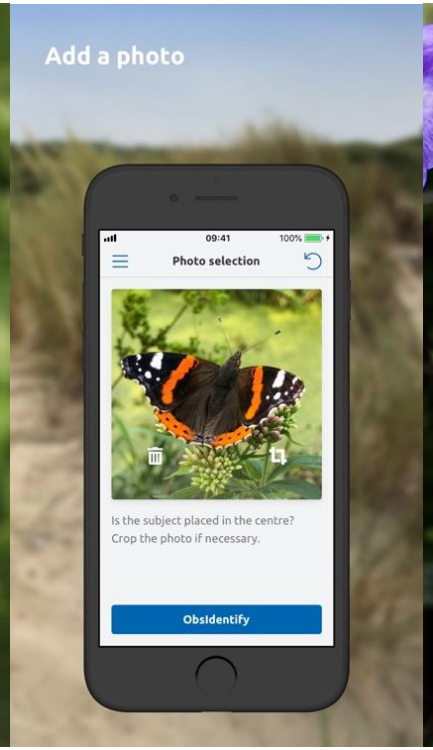
What is Artificial Intelligence?

Convolutional Neural Network (CNN)

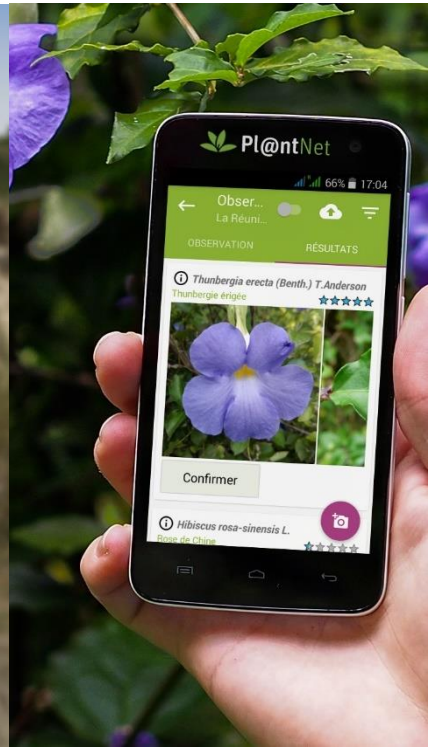


Mobile apps

Seek (iNaturalist)



ObsIdentify

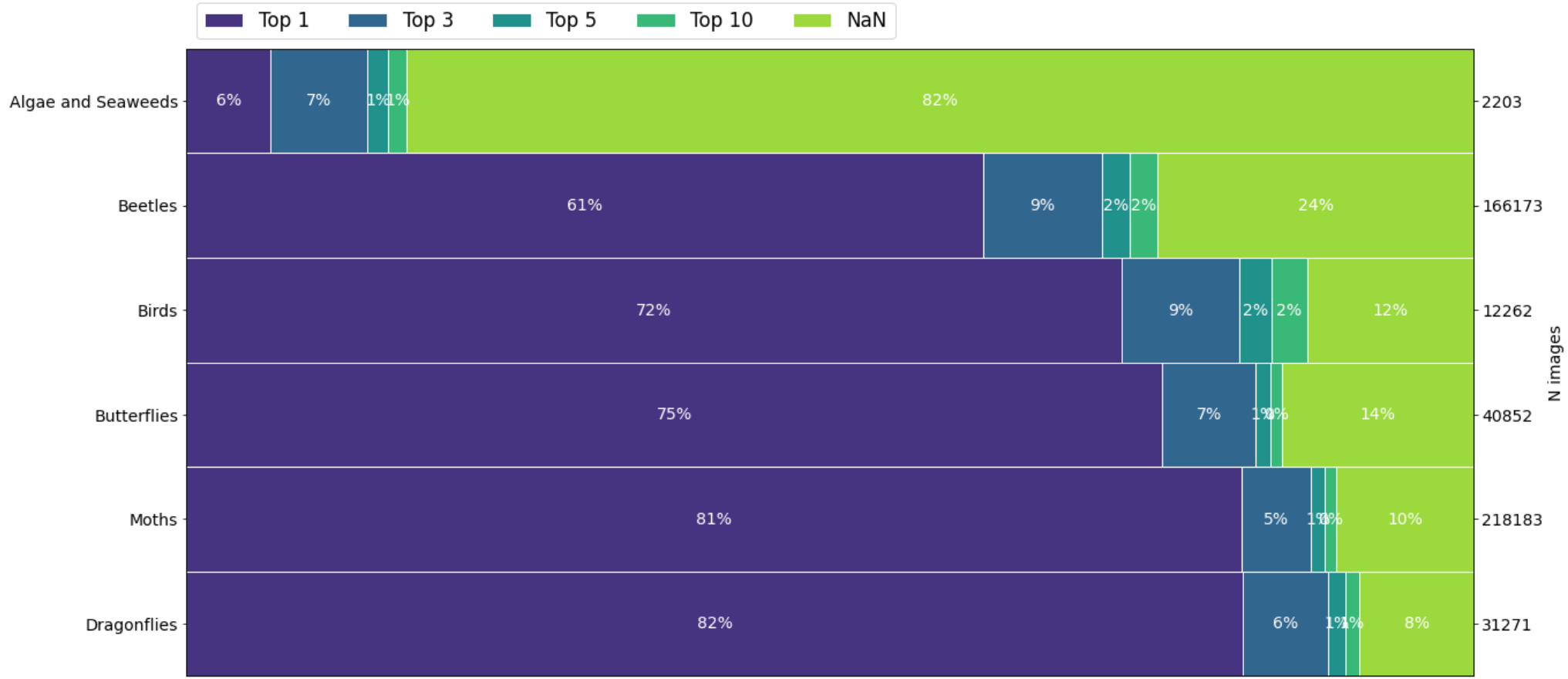


Pl@ntNet

Nature Identification API (NIA)

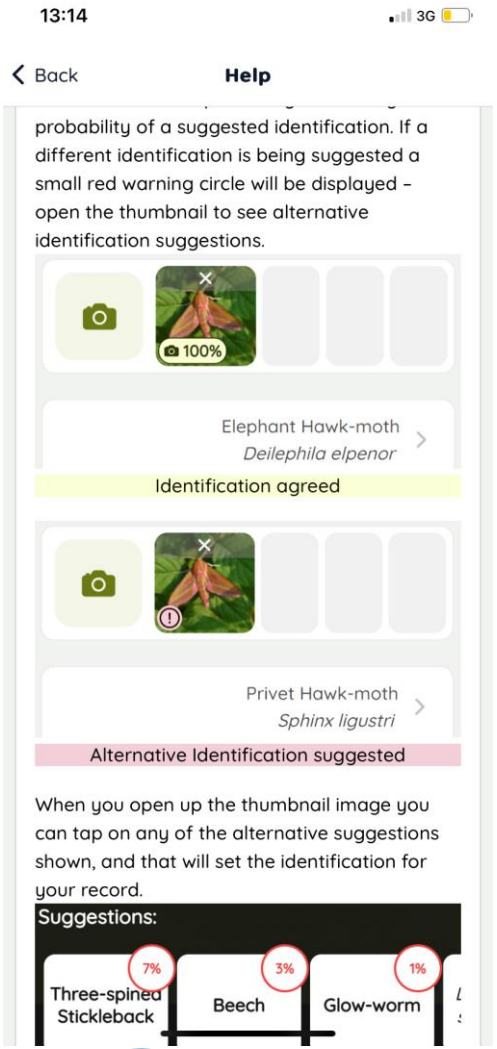
- Tested the Observation.org image classifier (https://observation.org/pages/nia-explain/) on >875,000 images submitted for ~12,500 taxa in the UK via iRecord.
- Only images that had been ‘verified’.

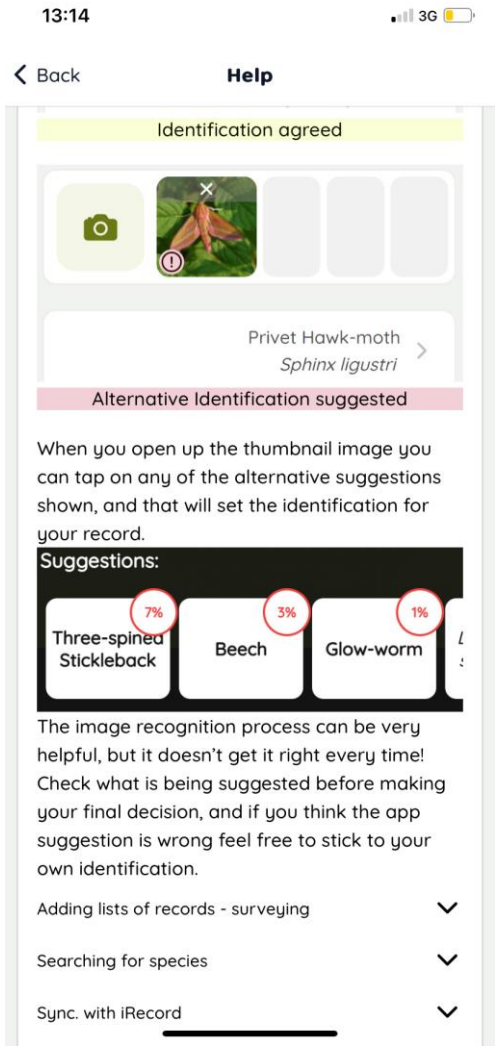
Nature Identification API (NIA)



875,000 images -> 22.55% were not found.

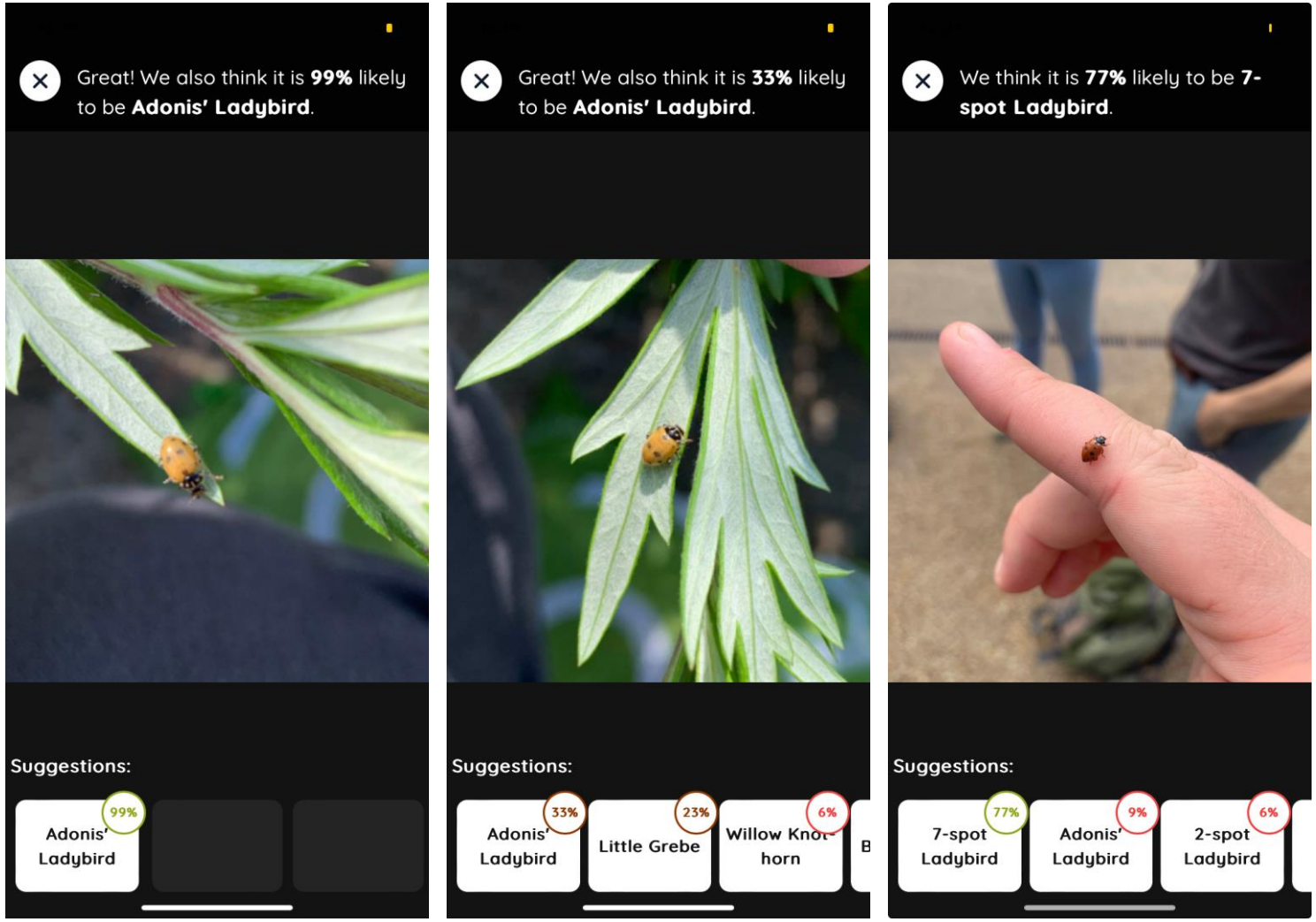
iRecord: NIA implementation





- Take advantage of AI to assist with identification.
- Photos added to the app are classified and identifications are suggested, along with a measure of probability.
- The app also flashes up a warning sign if it disagrees with your ID and it gives you a suggestion for each image.
- With lots of photos, it gives a percentage for each.
- Help to support users and verifiers. The AI makes suggestions but is not used to verify any records.
- Human verifiers can focus on the records that might be doubtful.

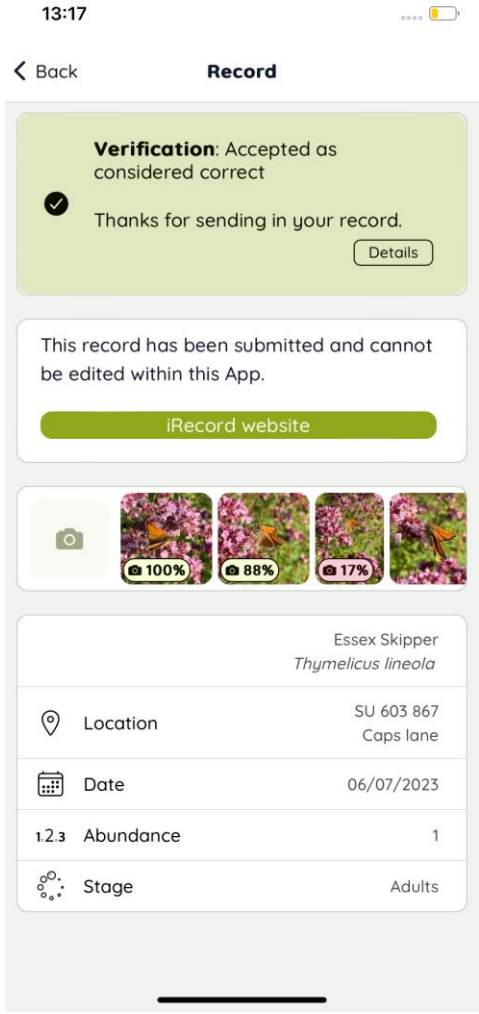
NIA limitations

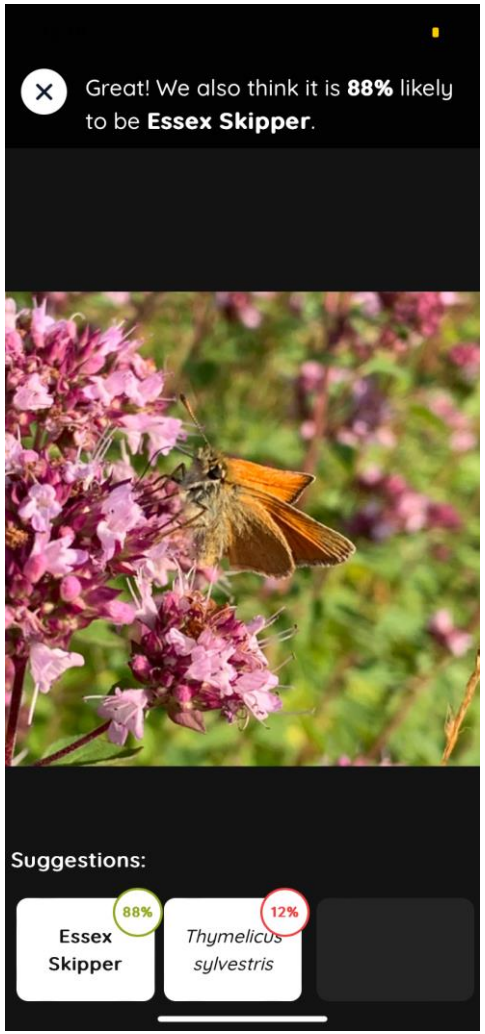


- Number of images available.
- Different weather and backgrounds.
- Upload several images if possible.

Future opportunities

- Potential for how we could use image classifiers more within iRecord, to help support users and verifiers.
- Use the AI as a quality control step by flagging potential misidentified images that need to be reviewed by experts.
- Combine the AI with other metadata like phenology or location to give more accurate suggestions.
- Feedback and new ideas.





Introducing AMI

UK Centre for
Ecology & Hydrology

AMI: Autonomous Monitoring of Insects

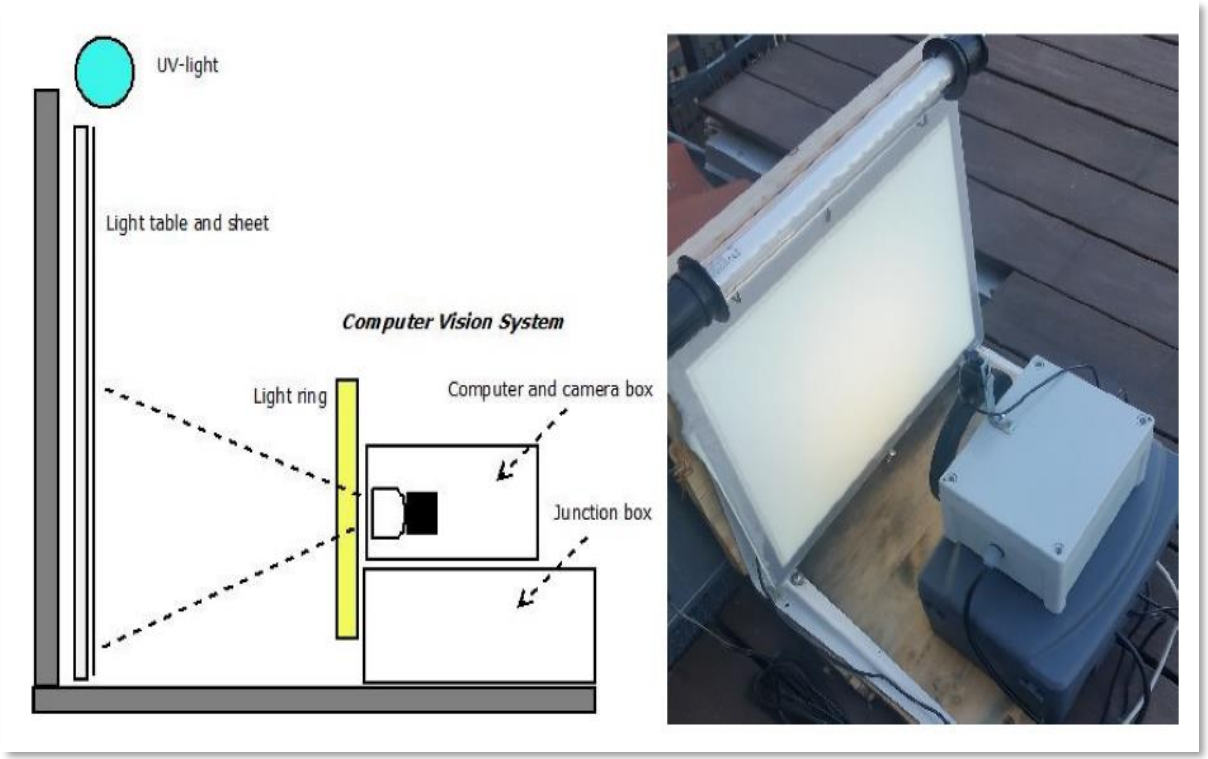
Alternative to manual collection, sorting, and classification

- Long-term & time-efficient
- Non-lethal
- Standardised

Why moths?

- Pollinators
- Food source for birds and mammals
- Respond quickly to change in habitat quality
  - = good indicator group
- Easy monitoring via their attraction to light

Hardware



Aarhus University - Bjerge, 2021

UKCEH

ML workflow

Estimating accuracy

All images

Split 5:1

Training images

Test images

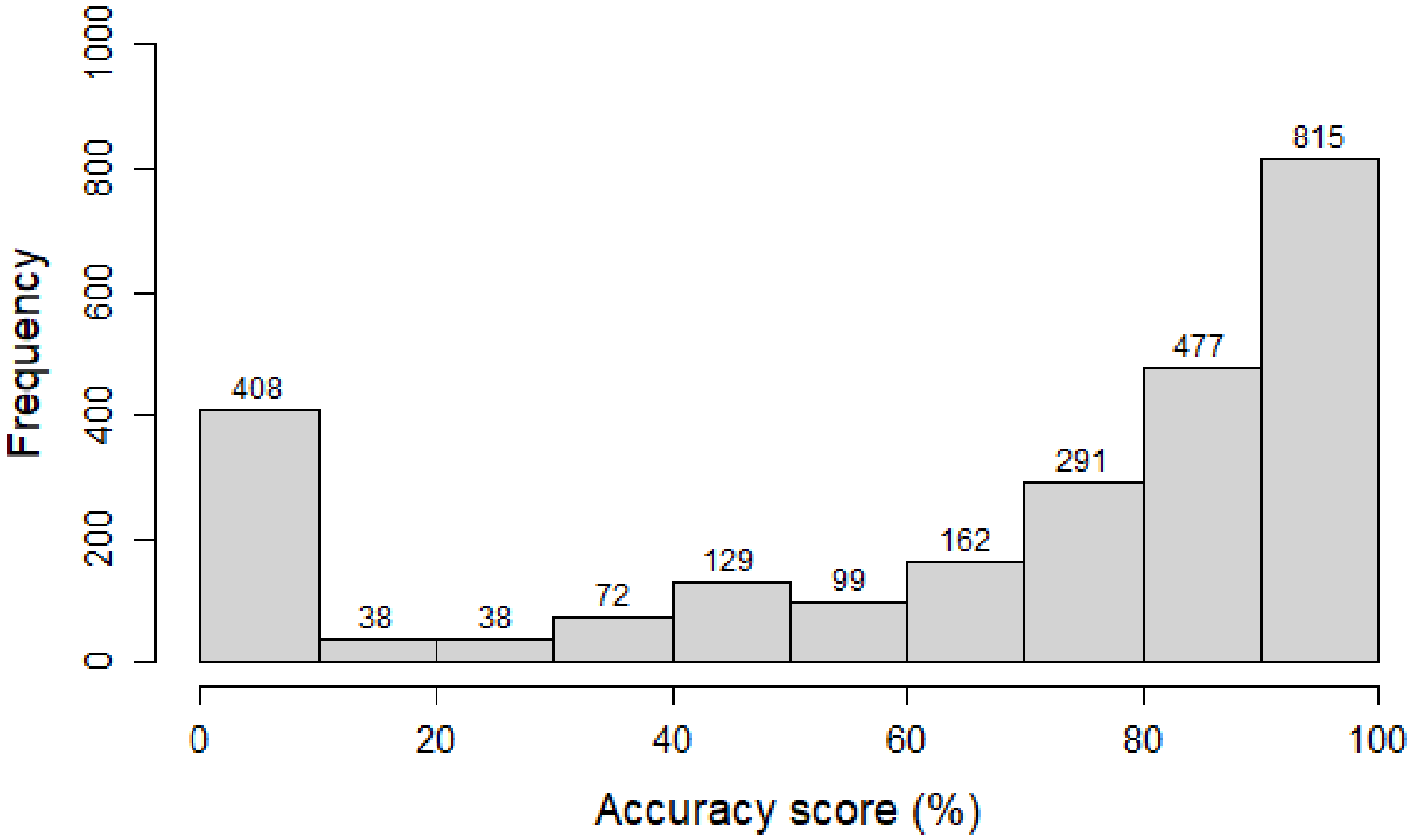
GBIF Global Biodiversity Information Facility

UK Centre for Ecology & Hydrology

Estimating accuracy

Species name	Number of training images	Number of test images	Accuracy score (%)
Abraxas grossulariata	750	150	91
Abrostola tripartita	750	150	57
Abrostola triplasia	750	150	83
Acasis viretata	750	150	91
Acentria ephemerella	750	150	95
Abraxas sylvata	685	137	93
Acherontia atropos	520	104	93
Abrostola asclepiadis	95	19	68
Abraxas pantaria	10	2	0
Acanthopsyche atra	5	1	0

Accuracy varies between species



90%+ accuracy
for ~33% species

70%+ accuracy
for >60% species

Accuracy varies between species

Angle shades
(*Phlogophora meticulosa*) **85%**

Magpie moth
(*Abraxas grossulariata*) **91%**

Antler moth
(*Cerapteryx graminis*) **95%**

Bramble Shoot
(Notocelia uddmanniana) **99%**

Langmaid's Yellow Underwing
(Noctua janthina) **5%**

- Hard to distinguish from *Noctua janthe*?

Mere Wainscot
(Photedes fluxa) **33%**

- Lack of distinguishable features?

Dark Umber
(Philereme transversata) **37%**

- Multiple variants?

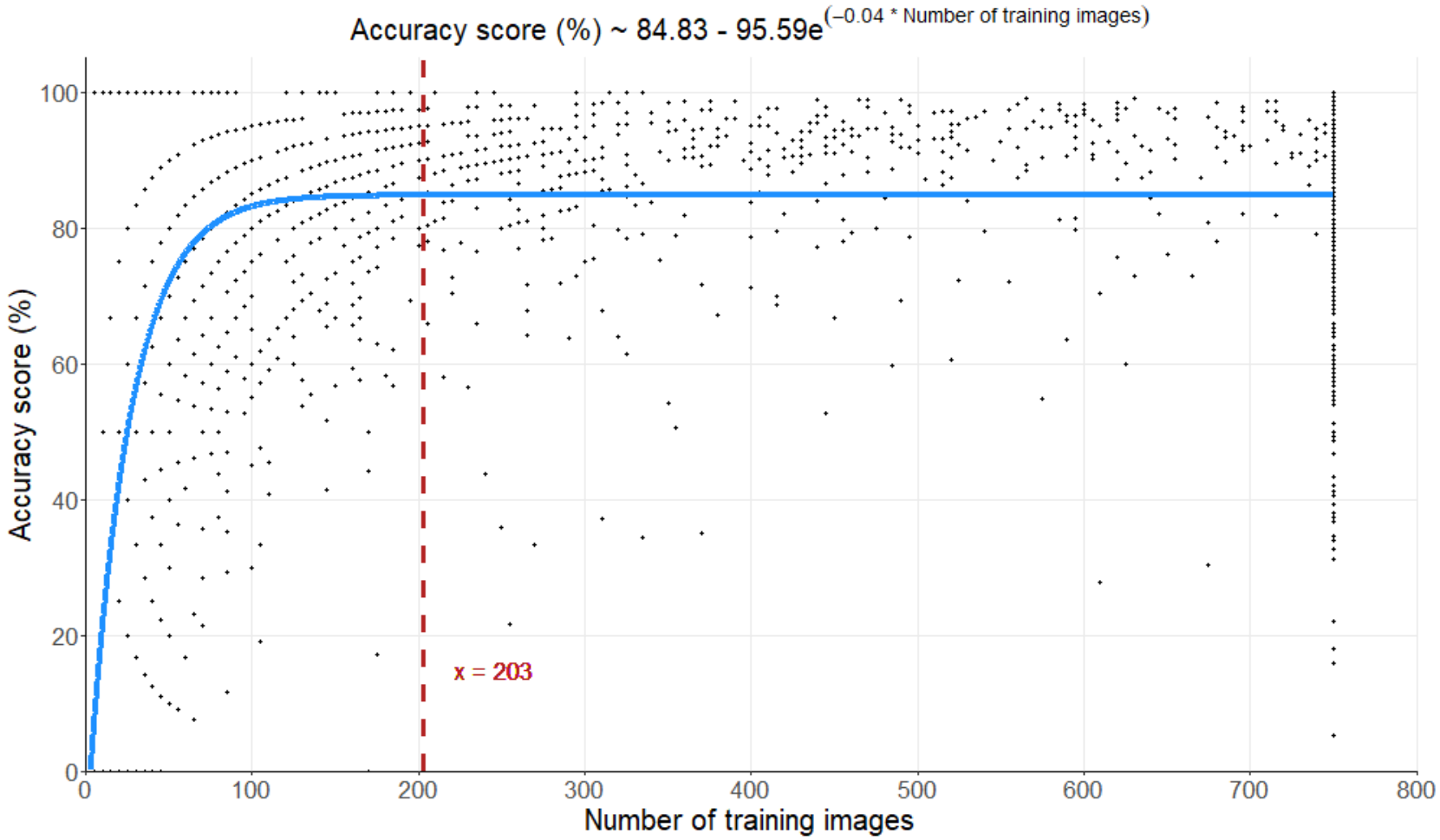
Some species have few images

Small hazel purple
(*Paracrania chrysolepidella*)

Hemlock yellow conch
(*Aethes beatricella*)

Fisher’s estuarine
(*Gortyna borelii*)

How many images is sufficient?



ID difficulty vs accuracy

1

The Herald
(*Scoliopteryx libatrix*)

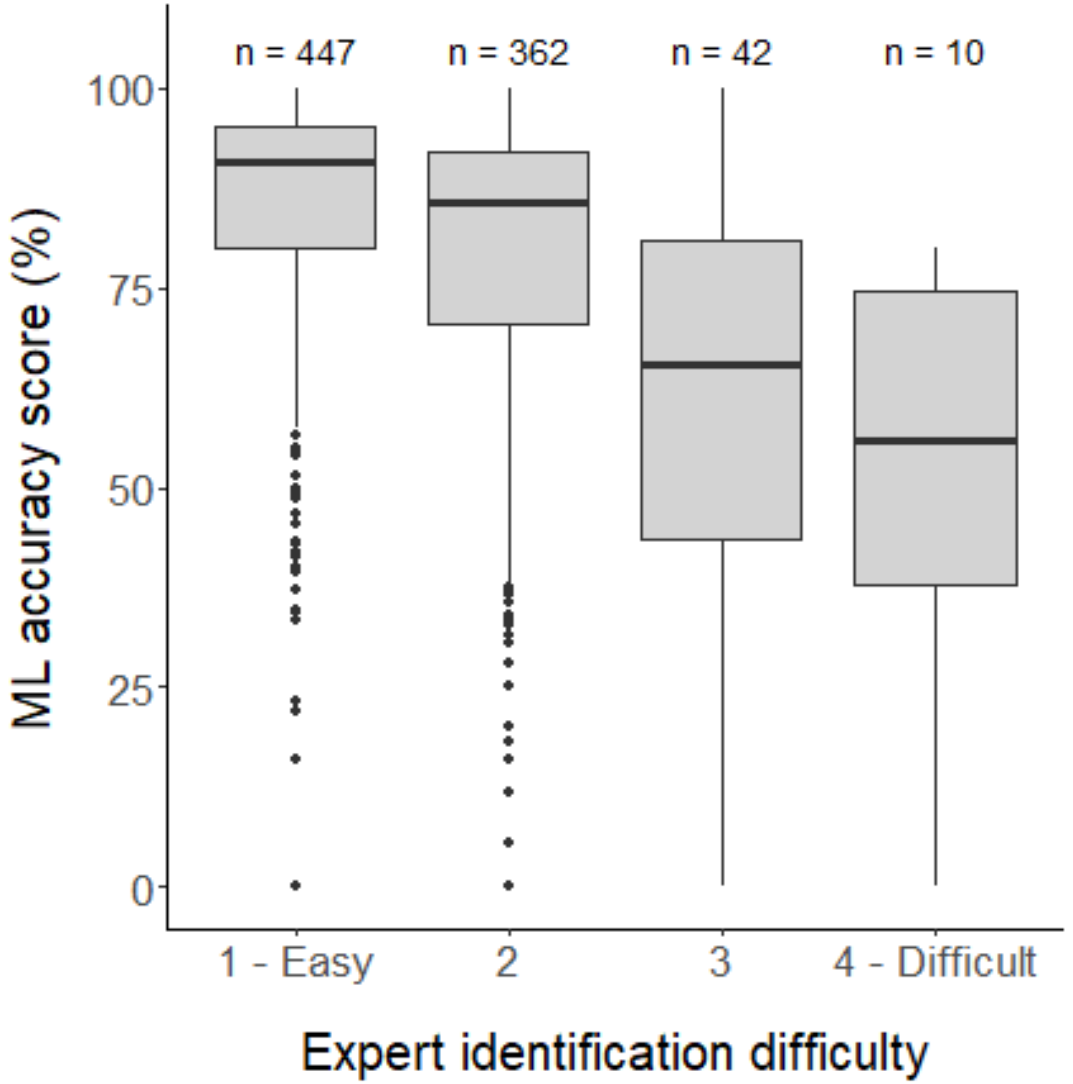
4

Marbled Minor
(*Oligia strigilis*)

Rufous Minor
(*Oligia versicolor*)

Tawny Marbled Minor
(*Oligia latruncula*)

Taxonomic experts and ML models struggle with the same species!



Conclusions

As a **complementary** method to traditional monitoring, AMI allows:

- Long-term continuous monitoring (e.g. remote nature reserves)
- Fast results (no sample sorting etc.)
- Potential to speed up identification of new species – more relevant overseas

Potential limitations and next steps:

- What should our confidence threshold be?
  - Important role for taxonomic experts!!
- More labelled training data required
  - Important role for taxonomic experts!!!
- Addition of acoustics

Thank you

For more info:
ceh.ac.uk/ukceh-ami-trap

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