aws

AWS Heroes in 15:

Bear Conservation with ML, Serverless
and Citizen Science

Ed Miller (he/him)

Senior Principal Engineer, Strategic Alliances Technical Marketing, Arm
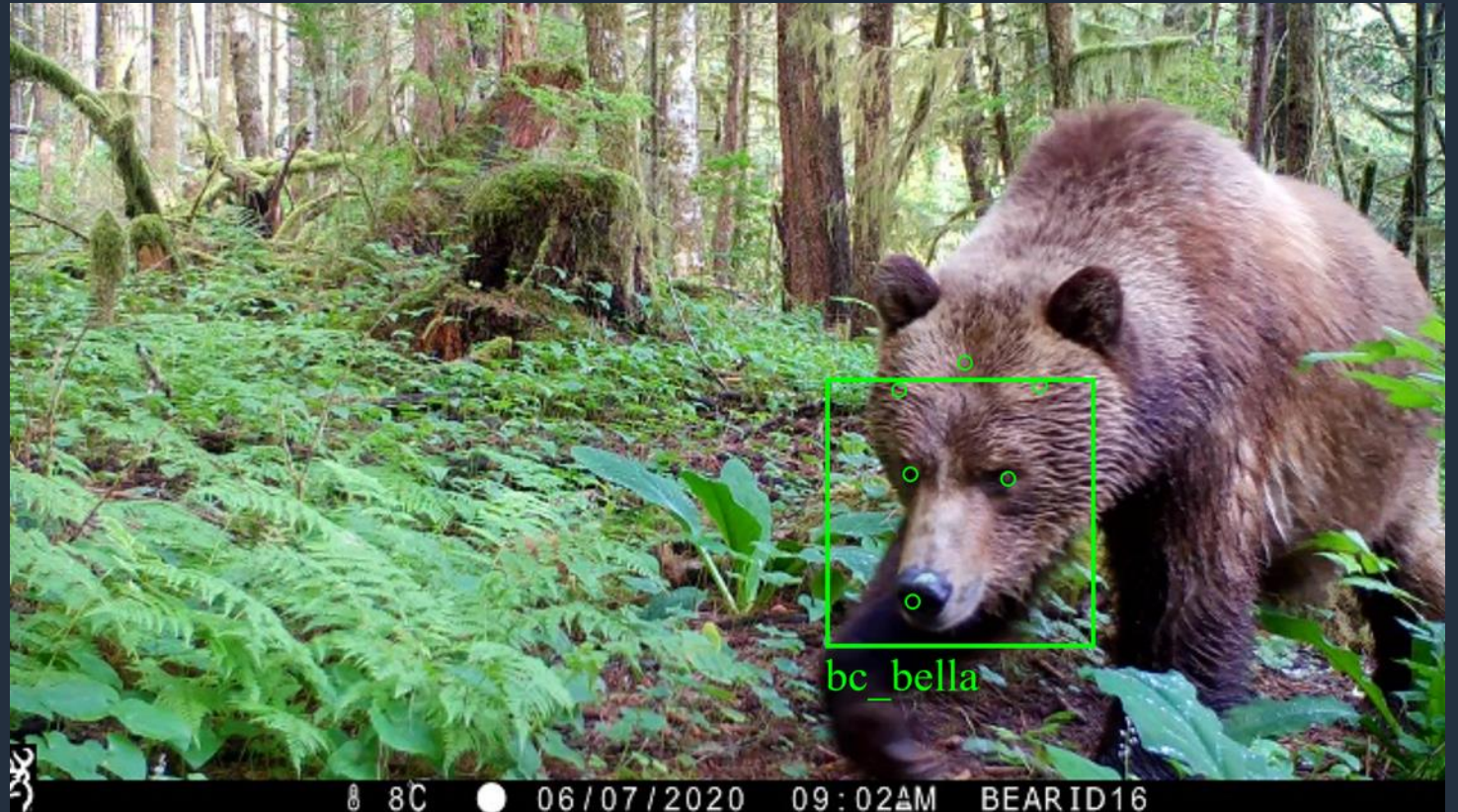Director and Developer, BearID Project

Agenda

BearID Project

Explore.org

Bearcam Companion

What's next

Links & Resources

BearID Project overview

Collaborative effort between ecologists and software engineers

Develop a robust, open-source, automated software tool to identify individual bears with >90% accuracy
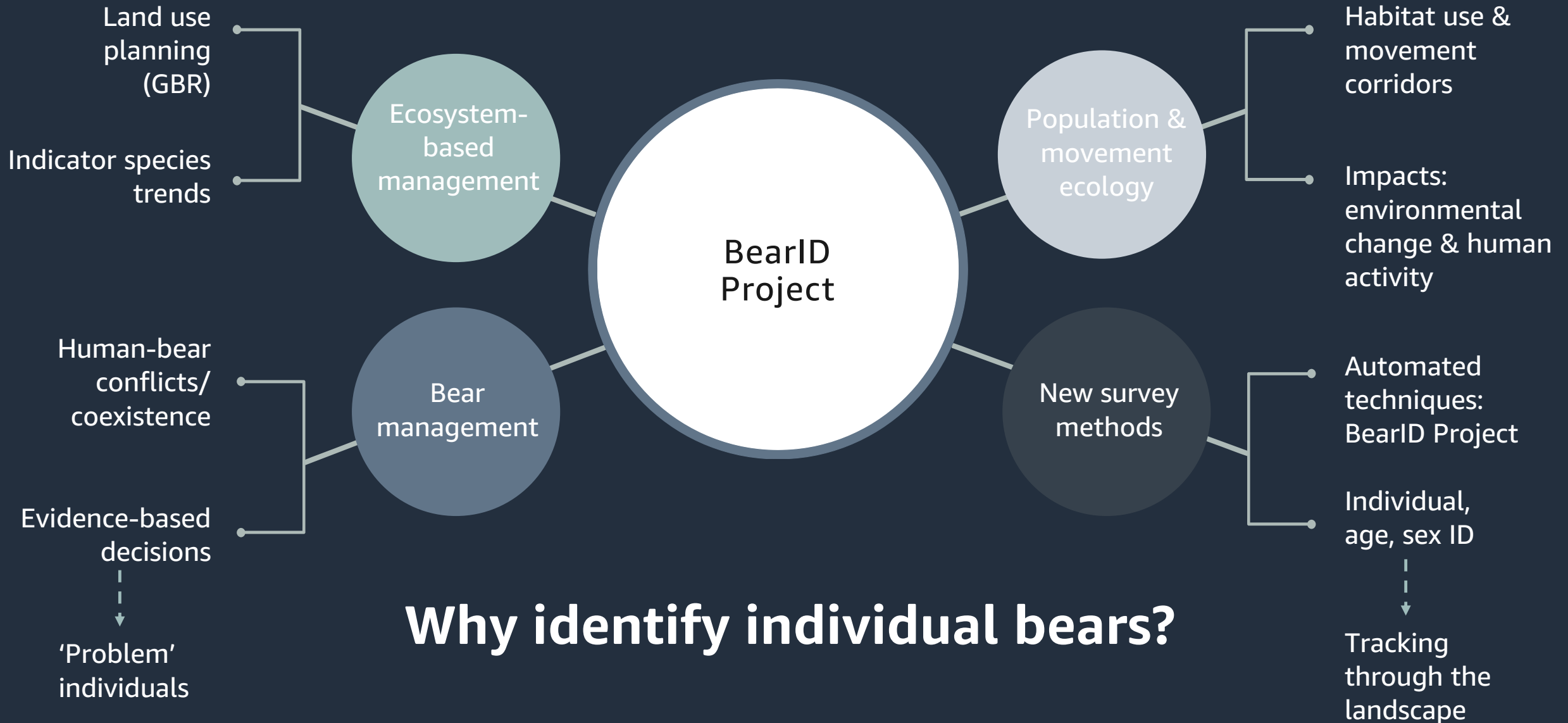
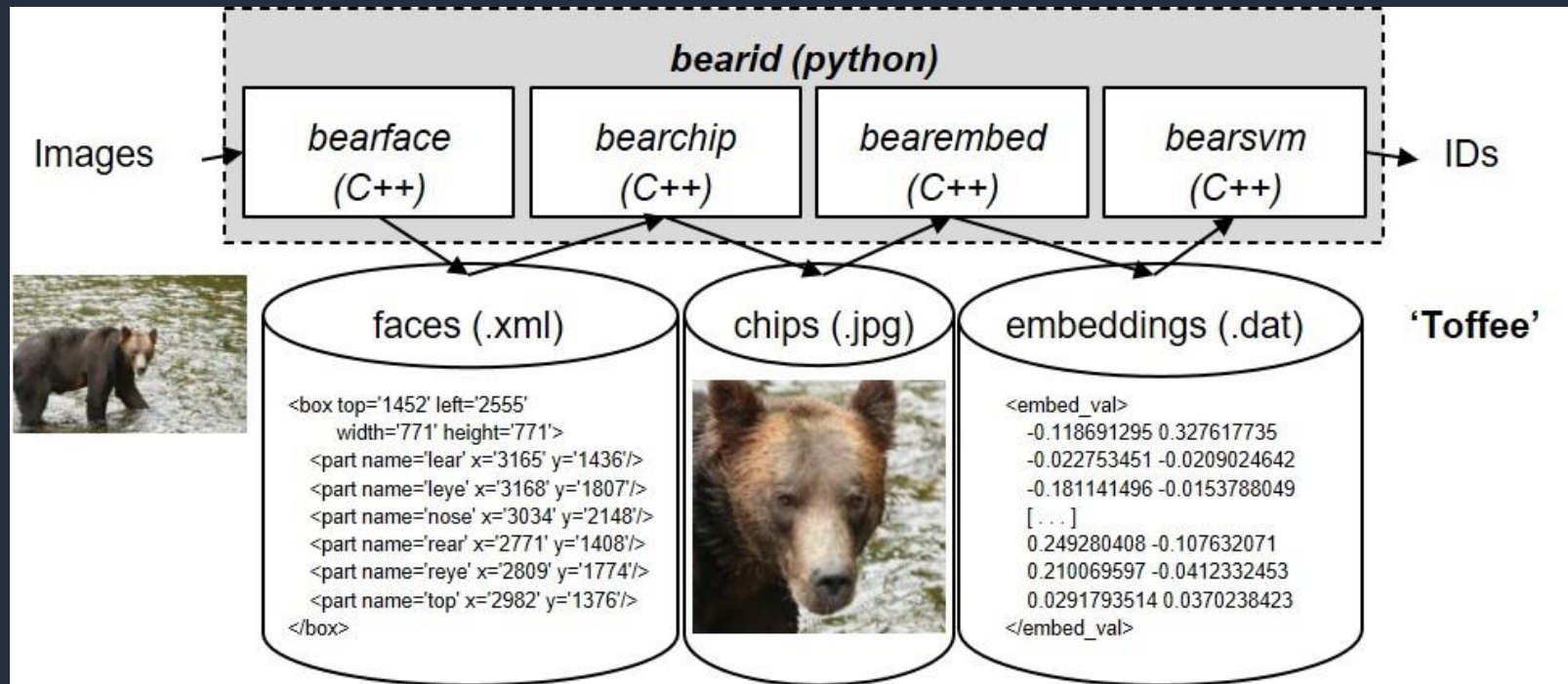Current photo-ID via face recognition results:

Brown bears (wild, DSLR)

Detection = 0.98, Classification = 84%

Clapham et al. (2020) Ecol and Evol, 10 (23)

Land use planning (GBR)

Indicator species trends

Ecosystem-based management

BearID Project

Population & movement ecology

Habitat use & movement corridors

Impacts: environmental change & human activity

Human-bear conflicts/ coexistence

Evidence-based decisions

Bear management

New survey methods

Automated techniques: BearID Project

Individual, age, sex ID

'Problem' individuals

Why identify individual bears?

Tracking through the landscape

Bear identification ML pipeline

"FaceNet: A Unified Embedding for Face Recognition and Clustering," (Schroff et al., 2015)
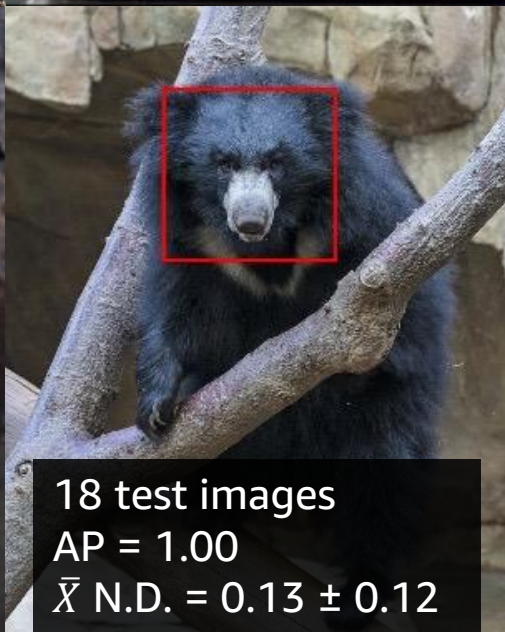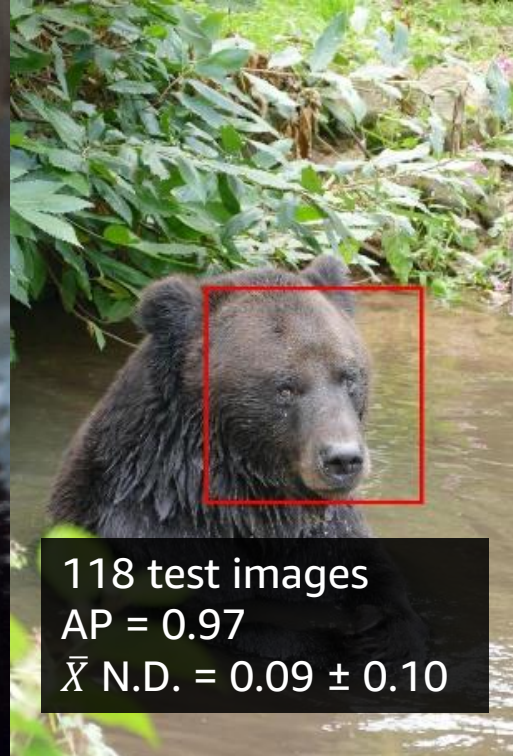
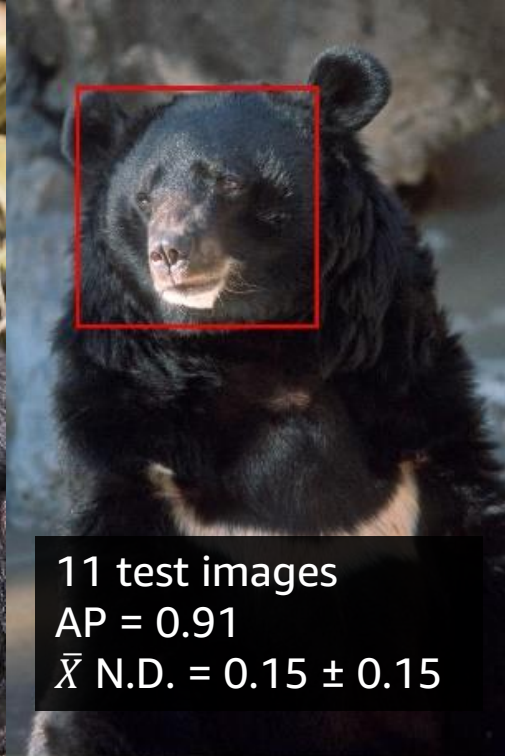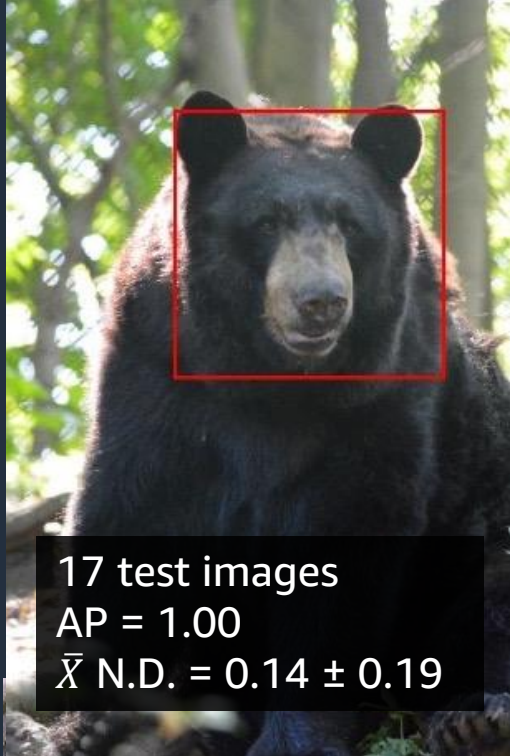San Diego Zoo Wildlife Alliance

Bears in Mind

STIFTUNG für BÄREN

All species

438 test images

Average Precision = 0.96

$\bar{X}(\pm$ SD) normalized distance = 0.08 ± 0.12

17 test images
AP = 1.00
$\bar{X}$ N.D. = 0.14 ± 0.19

121 test images
AP = 0.98
$\bar{X}$ N.D. = 0.06 ± 0.06

11 test images
AP = 0.91
$\bar{X}$ N.D. = 0.15 ± 0.15

118 test images
AP = 0.97
$\bar{X}$ N.D. = 0.09 ± 0.10

37 test images
AP = 0.97
$\bar{X}$ N.D. = 0.10 ± 0.23

96 test images
AP = 0.97
$\bar{X}$ N.D. = 0.07 ± 0.09

18 test images
AP = 1.00
$\bar{X}$ N.D. = 0.13 ± 0.12

20 test images
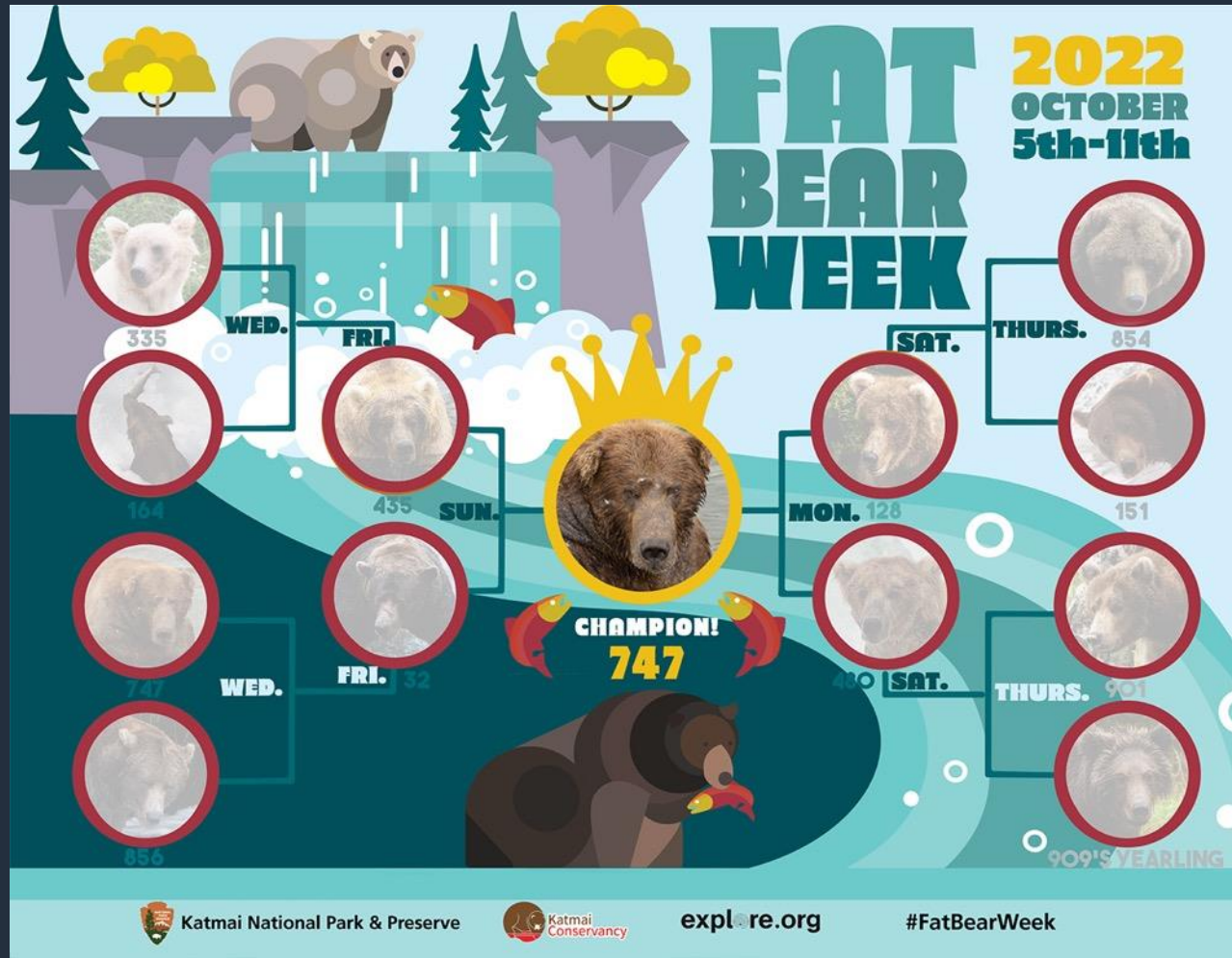AP = 0.92
$\bar{X}$ N.D. = 0.09 ± 0.08

Explore.org

- Brooks Falls Brown Bears
  - Katmai National Park
  - 6+ webcams
- Disqus/YouTube/Facebook
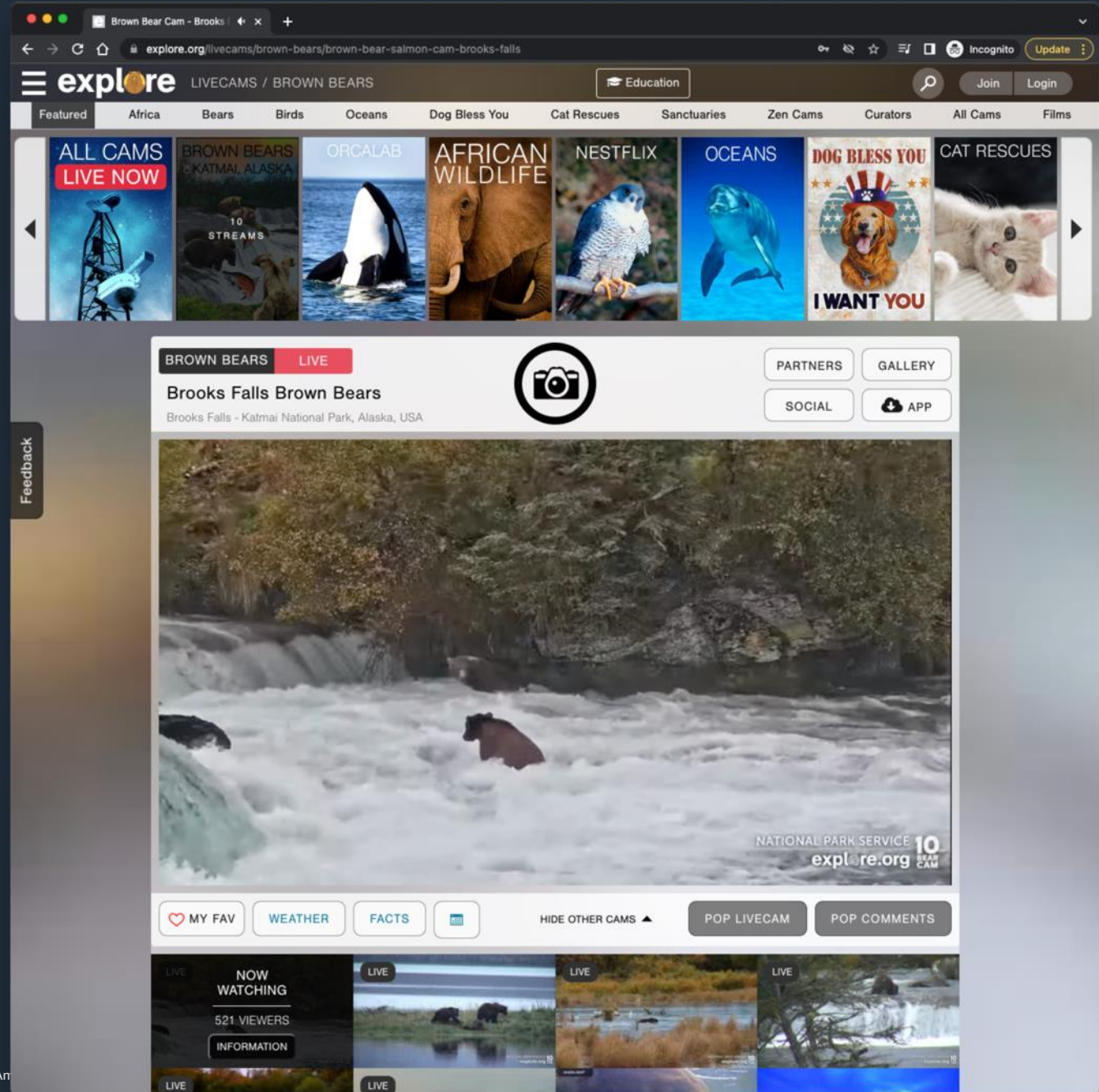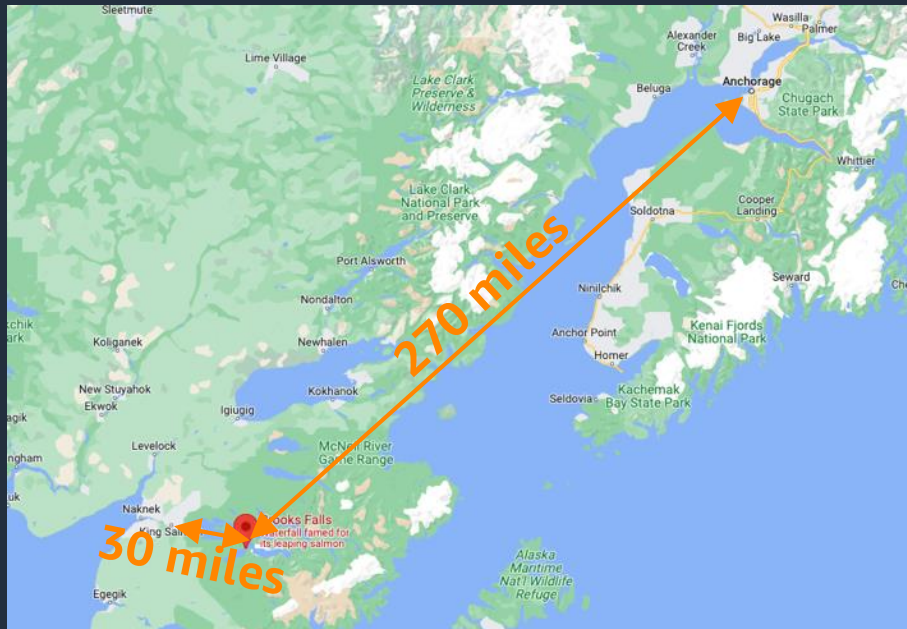
Fat Bear Week

Explore.org Demo

Working with webcams

Disadvantages

- Video quality

- Not always the best angle

- Live streaming

Advantages

- Virtual access to remote locations

- Someone watching all the time

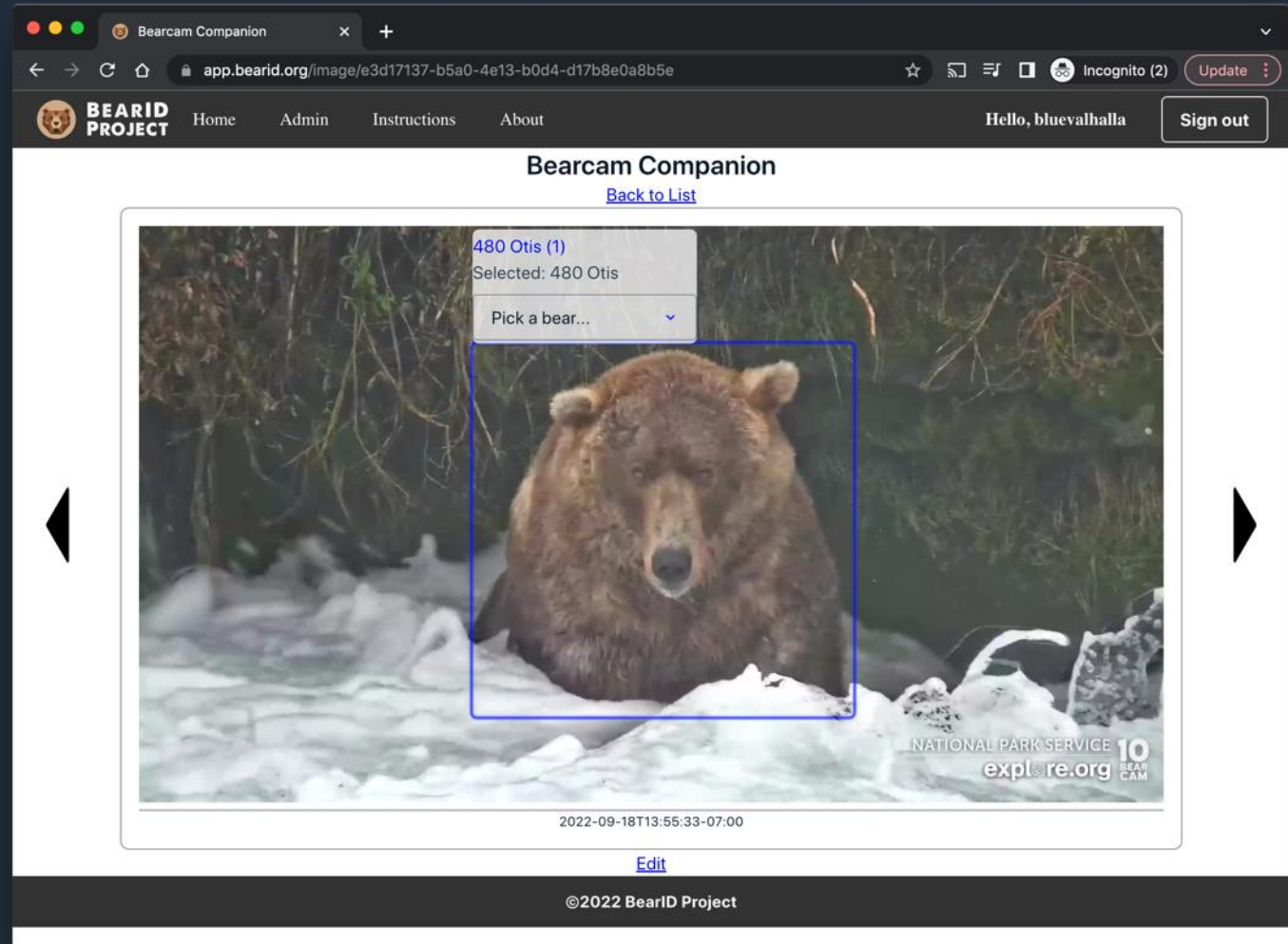- Very knowledgeable community (Citizen Scientists)

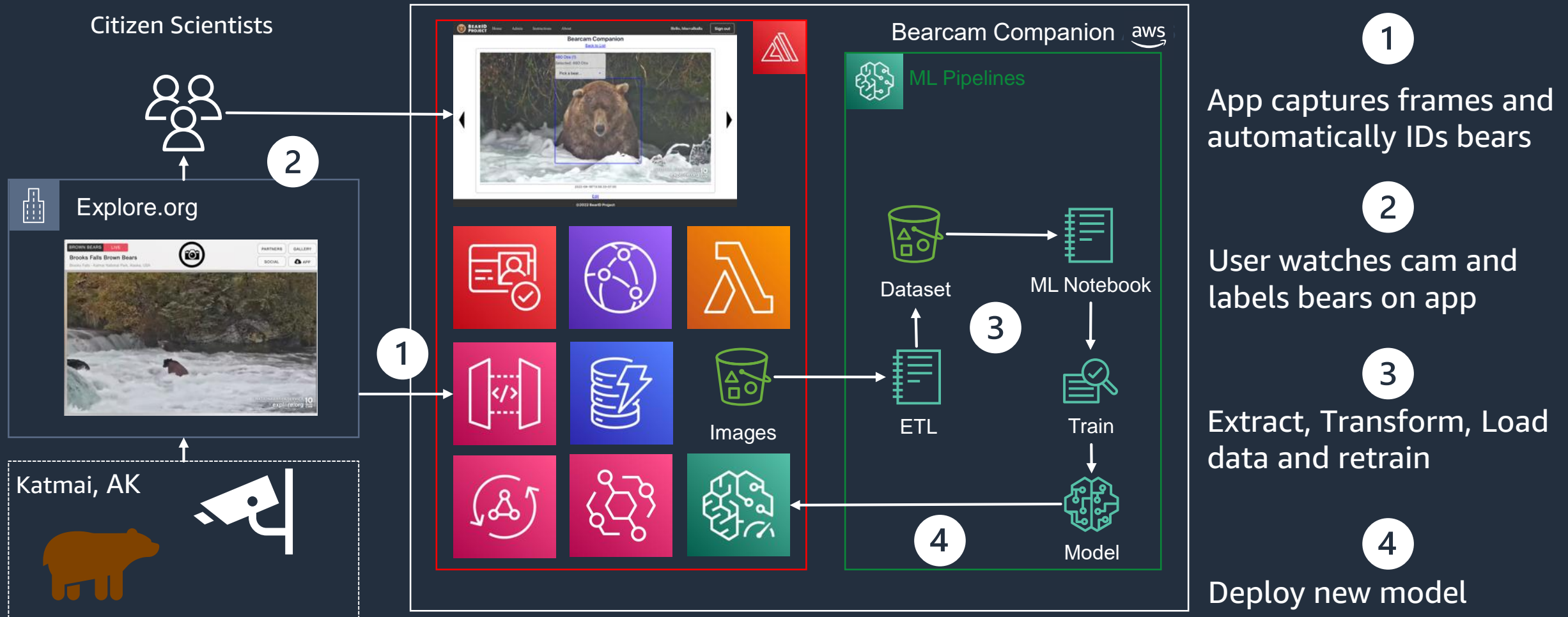Bearcam Companion

Amplify-ing bears
⚡🐻

Goals of the Bearcam Companion

- Develop a web application

- Engage bearcam community

- Human-in-the-loop ML

- Train model to ID bears on cams

- M♡P

  - Grab frames from cams
  - Auto-detect bears
  - Logged in users can ID bears
  - Users can view images and IDs
  - Admin mode for editing

Human-in-the-Loop

Citizen Scientists

Explore.org

Katmai, AK

Bearcam Companion

ML Pipelines

Dataset → ML Notebook

ETL

Train

Model

Images

1
App captures frames and automatically IDs bears

2
User watches cam and labels bears on app

3
Extract, Transform, Load data and retrain

4
Deploy new model
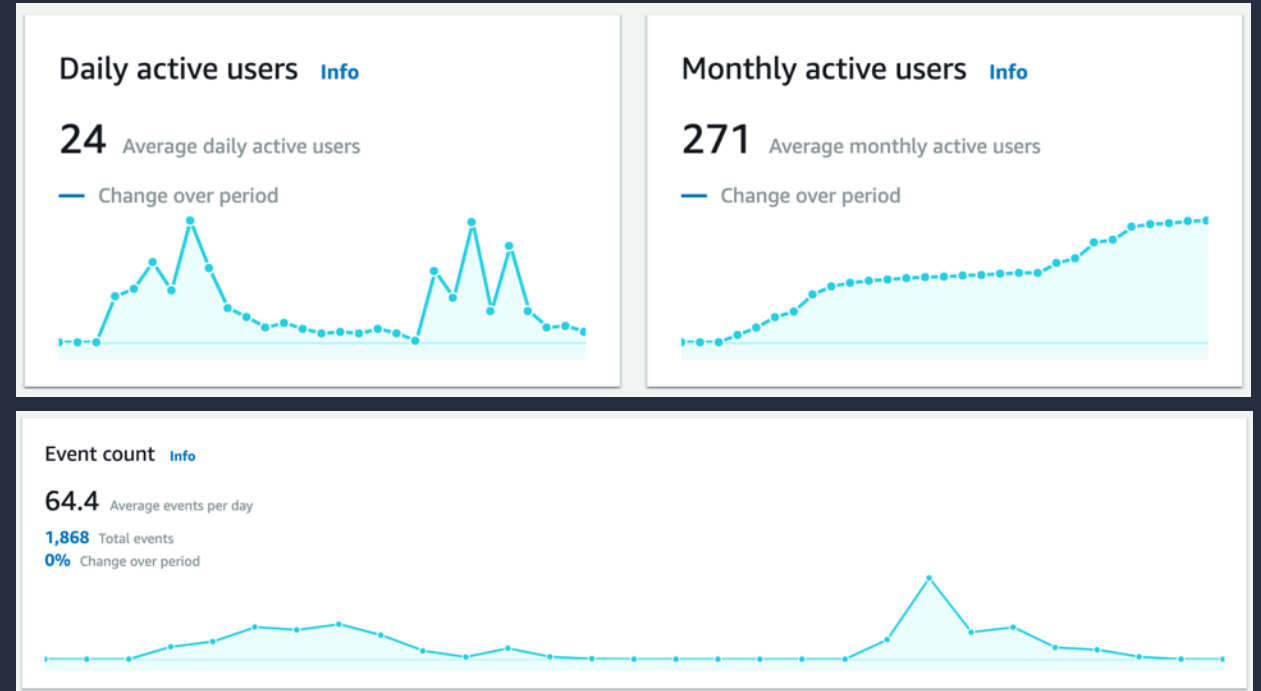
Bearcam Companion Demo

Results so far

- Launched in August 2022

- Stats (from Amplify Studio)

  - Users: 300+

  - Images: 4,000+

  - Objects: 8,000+

  - Identifications: 4,000+

- Enabled Amazon Pinpoint

  - Usage metrics

  - Event metrics

What's next?

Bearcam Companion

- Develop HITL pipeline

- Develop/improve models

- Support more cams

BearID

- Explore new models

- Video tracking

- On-device ML

Links and Resources

BearID and Webcams

- BearID Project

- Bearcam Companion

- Bearcam Companion blogs

- Explore.org

  - Explore Brown Bear Cams

  - Explore Snapshots

Communities and Projects

- **WILD**LABS.NET

- Conservation X Labs Challenges

- FruitPunch AI Challenges

- iNaturalist

- Zooniverse

THE END

Thank you!

Ed Miller

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linkedin.com/in/bluevalhalla/