"AutoCattlogger" You herd it right!

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Track-assisted, automatic, instant cattle identity cataloger for recognition and beyond [1]

Context

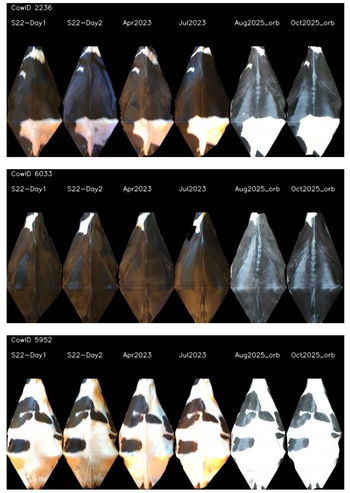
- Cattle farms must monitor hundreds of cows.
- Computer-vision systems enable non-intrusive identification and monitoring of cattle.
- A computer-vision based cattle identification system supports a stack of downstream applications.

Challenges

- Limited labeled data for training
- Limited time to learn new cow IDs
- Changing lighting conditions

Changing lighting conditions

- Sample images of same cows on different days:



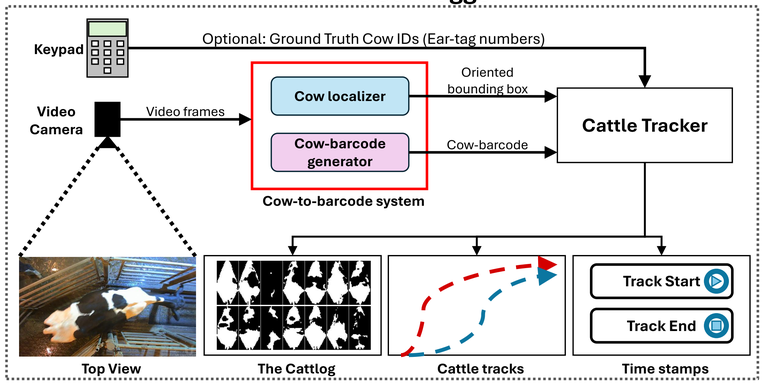
Thanks to students and workers at the Purdue dairy and to Dr. Jacquelyn P. Boerman for helping us with setting up cameras and collecting the required data.

Our policy

- Use stochastic, learning-based models for tasks which humans are innately good at.
  - e.g.: identifying parts of a cow's anatomy - which look the same across all cows.
- Use deterministic, non-learning-based algorithms for tasks which computers are historically good at.
  - e.g.: memorizing the appearances of hundreds of cows and finding the best match.

Identification systems based on Deep Learning/Deep Metric Learning methods must memorize an impossibly large number of cow patterns for them to work without retraining, and that is not a practical solution.

The AutoCattlogger



Cow-to-barcode system

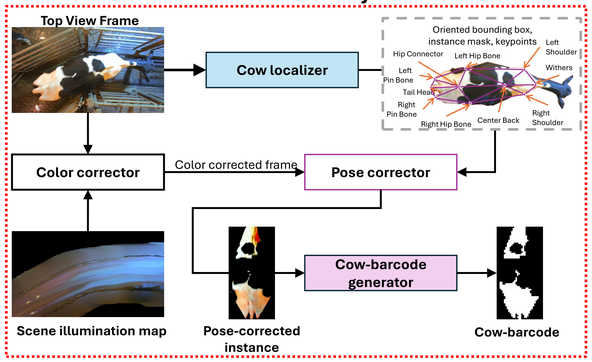
Black-Mirror Light-Probes[2] for color correction

Model a black cow as a black-mirror.

Track it and accumulate reflections into a scene illumination map.

Extend the map to unseen regions.

Use the map to color-correct other cows in the same scene.



Data

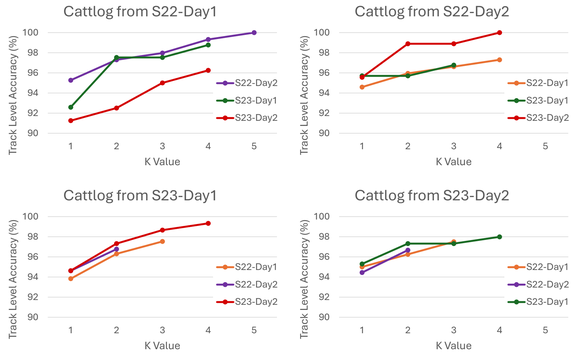
- Videos of cows walking after being milked
- Data from two days of Summer 2022 (S22) and two days of Summer 2023 (S23).

Table: Number of common cows between days.

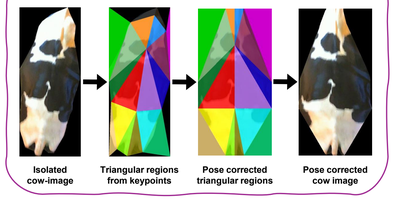
	S22-Day1	S22-Day2	S23-Day1	S23-Day2
S22-Day1	153	148	81	80
S22-Day2	148	169	93	90
S23-Day1	81	93	177	149
S23-Day2	80	90	149	175

Evaluation and results

- Cattlog from one day, identify cows on other days.

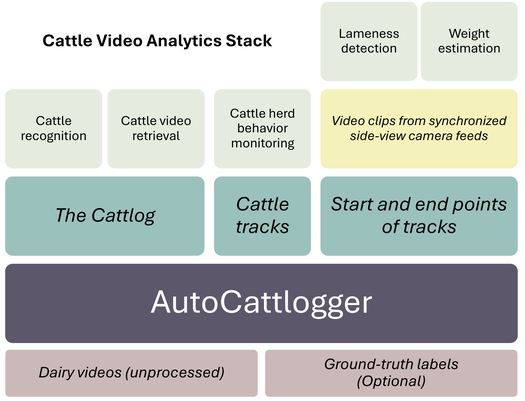


Pose Corrector



Building with the AutoCattlogger

- AutoCattlogger serves as the foundation for many cattle video analytics tasks.



TL;DR

Identifying cows is now as easy as scanning barcodes at a supermarket checkout station!

- First day:
  - Cows walk under a camera.
  - AutoCattlogger learns IDs instantly.
- Another day:
  - Cows walk under a camera.
  - AutoCattleID recognizes them.
- Videos not available? No problem!
  - We have one-shot learning.
- Cows looking too shiny? No problem!
  - We have automatic color-calibration.
- Datasets and model weights are available.
  - Visit our GitHub repository.

Key References

- [1] M. Ramesh and A. R. Reibman, "AutoCattlogger: Track-assisted, automatic, instant cattle identity cataloger for recognition and beyond", Smart Agricultural Technology 12 (2025) 101561, https://doi.org/10.1016/j.atech.2025.101561.
- [2] M. Ramesh and A. R. Reibman, "Black-Mirror Light-Probe Cow Model For Specular Highlight Removal To Improve Holstein Cattle Identification," 2025 IEEE International Conference on Image Processing Workshops (ICIPW), Anchorage, AK, USA, 2025, pp. 316-321, doi: 10.1109/ICIPW68931.2025.11386210.