Week 2 Document Submission

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1. Paper

Wäldchen J, Mäder P. Machine learning for image based species identification. *Methods Ecol Evol*. 2018; 9: 2216–2225. https://doi.org/10.1111/2041-210X.13075

SUMMARY

The text discusses the importance of accurate species identification in various fields of biological research and the potential of machine learning, particularly deep learning neural networks, for automated species identification based on image data. It highlights the advancements in using deep learning for species identification, the challenges faced in training models, and the potential applications of automated identification systems in biodiversity research and conservation efforts. The text emphasizes the need for high-quality training data, the role of citizen science in data collection, and the future prospects of integrating machine learning techniques with traditional taxonomic studies to enhance species identification processes.

2. Scripts

No scripts have been completed. I am working on an efficient way to extract large amounts of images from iNaturalist.

3. Documentation

This week I met with Dr. Stroud and was given more specifics on the data set he would like to use. This is a change from the initial requirements from Breanna so I am updating how to call the API.

4. Results Vizualization

No results to share.

5. Next Weeks Proposal

I will explore whether there is a need for an AWS work environment to pull in iNaturalists AWS opendata set as a resource or if it makes more sense to sequentially download images using a curl command to safe on my personal device to train with.

Weekly Report

Philip Woolley

2024-08-30

Time Log Reponse:

- What Progress did you make in the last week? - Met with Dr. Stroud, received clarification on project scope and deliverables. Downloaded sample of project dataset and manipulated using 3D Slicer.
- What are you planning on working on next? - Segment an example image using current SlicerMorph tools. Script Data download or conversion process for CT images.
- Is there anything blocking you? - None at this time

1 Abstract

Abstract

Animal biometrics is a challenging task. In the literature, many algorithms have been used, e.g. penguin chest recognition, elephant ears recognition and leopard stripes pattern recognition, but to use technology to a large extent in this area of research, still a lot of work has to be done. One important target in animal biometrics is to automate the segmentation process, so in this paper we propose a segmentation algorithm for extracting the spots of Diploglossus millepunctatus, an endangered lizard species. The automatic segmentation is achieved with a combination of preprocessing, active contours and morphology. The parameters of each stage of the segmentation algorithm are found using an optimization procedure, which is guided by the ground truth. The results show that automatic segmentation of spots is possible. A 78.37 % of correct segmentation in average is reached. Keywords: Diploglossus millepunctatus, active contours, gamma correction, morphological filters, spots segmentation.

Summary This paper proposes an algorithm for automatic segmentation of spots on the skin of lizards. The authors' method makes use of the contrast in brightness between spots and surrounding skin when images are grayscaled, and draws contours around the bright spots. This method would not be suitable for jaw segmentation as it relies on visually distinct areas, however the structure of the paper is similar to what i would want to write. I believe that the figures they use do a good job of showing the processing steps visually which enhances the reader's understanding of the algorithm.

Citation [1] J. Giraldo and A. Salazar, "Automatic segmentation of lizard spots using an active contour model," arXiv.org, https://arxiv.org/abs/1603.00841 (accessed Aug. 30, 2024).

2 Scripts and Code Blocks

This week, I focused on downloading data and familiarizing myself with 3D slicer, there are no scripts for this week.

3 Documentation

https://www.morphosource.org/projects/0000C1059?locale=enpage=11sort=publication_status_ssi+
List of available MicroCT Datasets of anolis lizards that will be used for this project. When infrastructure for data storage is ready I will prepare documentation detailing the downloading and storage process.

https://slicermorph.github.io/ Documentation for SlicerMorph, an extension of the 3D slicer tool commonly used by Biologists.

https://github.com/jmhuie/SlicerBiomech Documentation for the Dental Dynamics module, which is a 3D slicer extension for calculating tooth stress from jaw segmentations. the outputs from my segmentation pipeline will need to be compatible with this module for analysis.

4 Script Validation (Optional)

There are no scripts to validate this week.

5 Results Visualization

There are no results visualizations this week.

6 Proof of Work

This week I focused on downloading the relevant data and 3D slicer as well as clarifying project requirements with Dr. Stroud.

7 Next Week's Proposal

- investigate suite of segmentation tools in SlicerMorph
- Segment an example image to clarify ground truth with Professor Stroud.
- Keep up with any required blog posts for webmaster role
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Week 2 report

Ruiqing Wang | Lizard CV team

Time slot response:

- What progress did you make in the last week?
  1. Review papers on DeepLabCut
  2. Help assembling paper report submissions and address report format.
  3. Met with Dr. Strout and set up the research aim.
  4. Familiar myself with video frame extraction and projects labeling
  5. Working on DeepLabCut projects and understand the code set up
- What are you planning on working on next?
  1. Keep diving deeper on papers.
  2. Keep working on small DeepLabCut project
  3. Check out the videos I got from Dr. Strout and start practice project.
  4. Check my allocation and performance if I got PACE access.
- Is anything blocking you from getting work done?
  1. Trying to get PACE access and start work.

Abstract

Paper: Multi-animal pose estimation and tracking with DeepLabCut

Summary: This paper introduces a new method using DeepLabCut to accurately track and identify multiple animals in videos, even when they are interacting closely or partially hidden. By training a network to predict graph edges and pruning less discriminative connections, the algorithm determines an optimal skeleton for grouping body parts, leading to improved assembly performance. This approach outperforms traditional methods, enhances assembly purity, reduces missing keypoints, and achieves high precision in animal identification and tracking across frames.

Methodology: The DeepLabCut has been expanded by utilizing advanced CV technique using OpenPose, EfficientNet, HRNet, and SORT. The system incorporates convolutional neural networks (CNNs) for accurate pose estimation and skeleton assembly.

Scripts and Code Blocks

No scripts or code since I am working on the DLC workshop and trying to set up working environment.

Documentation

No documentation for current code, updates will be uploaded once I get the computing resources

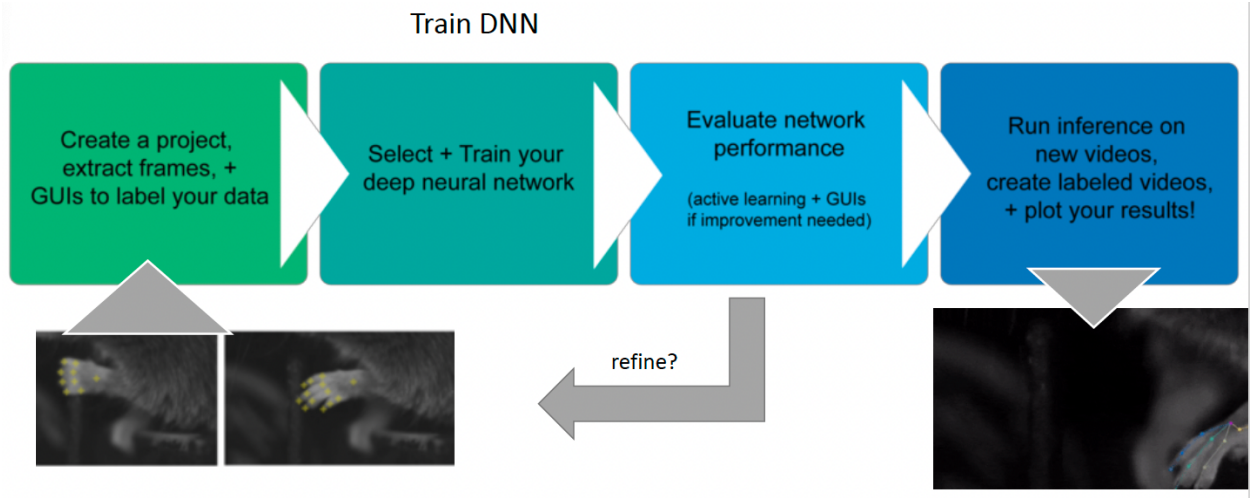
Results Visualization

N/A

Proof of work

This week I am working on understanding the build blocks of DLC and browse the video I got from Dr. Stroud. Here is the summary for the workshop.

The integration of annotation, training and inference could be summarized as below:



Here is the information for network architecture and augment:
Network architecture: Choose MobileNets V2 for speed or ResNets for accuracy. Consider scale for resolution handling.
Pre-training: Options include ImageNet (general), MPII (pose-specific), and DeepLabCut model zoo.
Training: Key factors are learning rate, optimizer (Adam/SGD), batch size, and augmentations (e.g., rotation, scaling).
Inference speed: Affected by image size and hardware. GPU recommended for better performance.

When selecting a network architecture, consider MobileNets V2 for speed and ResNets for robustness. Pre-training options include ImageNet (generalist), MPII pose (specialized), and models from the DeepLabCut model zoo. Key training parameters are learning rate, optimizer (Adam/SGD), and batch size, while augmentation methods like rotation and scaling enhance model performance. Inference speed is influenced by image size and hardware, with a GPU recommended for optimal performance.

The video I got contains moving projects including lizard and human hand. Based on current resources, I will probably consider labeling a few points on the hand to help the model distinguish it from the lizard. Use a robust network like ResNet-50 or ResNet-101 for accuracy, and implement data augmentation techniques to improve model generalization.

Next Week's Proposal

1. Using a practice code in getting familiar with DeepLabCut and related hardware
2. Start using platform as codelab to do a primary work on current video
3. Reach out to check if I could get the PACE access and check on the performance

Week 2 Document Submission

Lizard X-RAY Landmark Group

Mercedes Quintana

Abstracts:

ProctorXam - Online Exam Proctoring Tool

Abstract — Robust exam monitoring solutions are now essential in light of the most notable Covid-19 outbreak and the increasing inclination towards virtual learning. The automated method for supervising online exams that is suggested in this paper is intended to lessen the difficulties associated with exam cheating. With the assistance of our system's clever face detection algorithms, instructors may efficiently identify suspicious conduct by monitoring students' web activity and camera feed in real-time. Unlike earlier systems, ours provides improved accuracy and functionality, guaranteeing the authenticity of online tests. In light of the difficulties presented by the epidemic, this research attempts to offer a workable option for academic institutions and people wishing to administer fair and secure online exams.

Summary: This paper discusses a method to detect exam cheating using face detection and various algorithms. Through various machine learning methods, the tool can keep track of face angles, illegal tools during the exam such as cell phones, suspicious eye movement and face spoofing.

Scripts and Code Blocks:

I reworked existing code that errors detected between the ground truth and model predictions could be described in millimeters instead of pixel distance. Originally this was done by averaging the length of a known quantity in all pictures, a staple, but since the distance that the image is taken at is not always the same, averaging was not a good method. This code used the individual staple from each image to convert the error to millimeters. Only a couple lines were added to existing functions in landmark_model_performance.py: calculate differences, main.

Documentation:

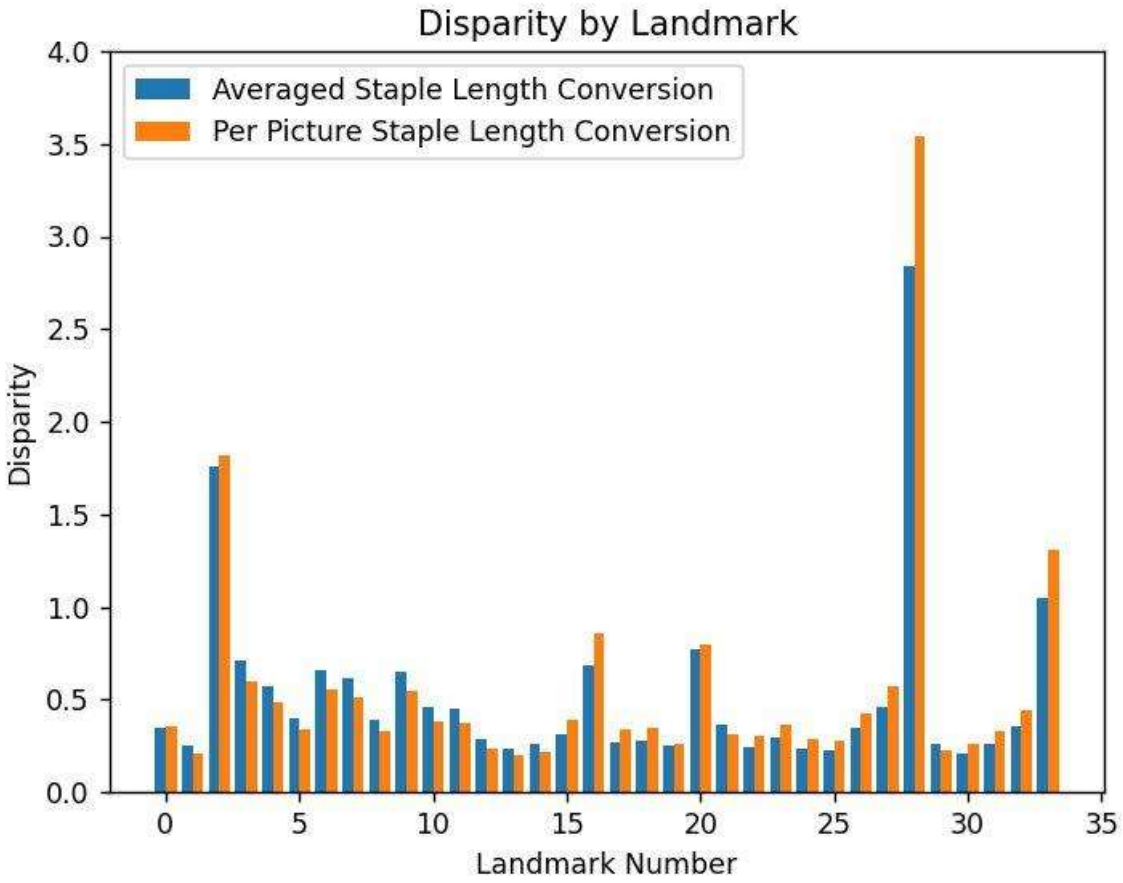
1. Use the function calculate ruler length to find the size of each staple.
2. Find the differences between the ground truth and the model output in pixels.
3. Convert and store millimeter conversion using each individual staple.

Script Validation:

I have no validation steps now.

Results Visualization / Proof of Work:

This is the change in the average landmark error after the individual staple length was used for the conversion.



Next Week Proposal:

Next week I plan to implement two ways to visualize the difference between the ground truth and model output. The first is to find a way to plot the ground truth and model output on one image of the lizard. The second is a per landmark output that shows all of the model's outputs across each image of one landmark to find direction. I also plan to set a meeting with Dr. Porto to discuss ml-morph, the current pipeline we use, and to research other methods.