

HAAG Weekly Report Week 1 s 2

Shuyu Tian

Lizard Jaw Segmentation

Jan 17, 2025

Time-Log

- Very brief sections of bullet points for the following:
 - **What did you do this week?**
 - My teammate Ming and I hosted a meeting with my internal project team (Ming, Philip, and Shuyu) on Wednesday at 5 PM EST.
 - We discussed prior progress made on the project and areas for improvement and further investigation, specifically on how the work done can be improved to become novel enough for publication
 - We gained access to past work done by Philip, specifically his GitHub repository and project documentation. We then reviewed the information
 - I signed up to be the Lizard Jaw Segmentation group's web manager
 - I developed an initial research plan with Ming, submitted last week
 - I gained access to MorphoSource to get access to data needed for research
 - **What are you going to do next week**
 - We will meet with our computational advisor on Monday, January 20th
 - We will resubmit our research plan based on feedback from Bree, specifically on how to execute our plan and reasoning behind our choices.
 - We will get access to data used by Philip to continue research
 - We will continue to read through the list of relevant research Philip provided
 - Blockers, things you want to flag, problems, etc.
 - N/A

Abstracts:

Abstract

Teeth reveal how organisms interact with their environment. Biologists have long looked at the diverse form and function of teeth to study the evolution of feeding, fighting, and development. The exponential rise in the quantity and accessibility of computed tomography (CT) data has enabled morphologists to study teeth at finer resolutions and larger macroevolutionary scales. Measuring tooth function is no easy task, in fact, much of our mechanical understanding is derived from dental shape. Categorical descriptors of tooth shape such as morphological homodonty and heterodonty, overlook nuances in function by reducing tooth diversity for comparative analysis. The functional homodonty method quantitatively assesses the functional diversity of whole dentitions from tooth shape. This method uses tooth surface area and position to calculate the transmission of stress and estimates a threshold for functionally homodont teeth through bootstrapping and clustering techniques. However, some vertebrates have hundreds or thousands of teeth and measuring the shape and function of every individual tooth can be a painstaking task. Here, we present *Dental Dynamics*, a module for 3D Slicer that allows for the fast and precise quantification of dentitions and jaws. The tool automates the calculation of several tooth traits classically used to describe form and function (i.e., aspect ratio, mechanical advantage, force, etc.). To demonstrate the usefulness of our module we used *Dental Dynamics* to quantify 780 teeth across 20 salamanders that exhibit diverse ecologies. We coupled these data with the functional homodonty method to investigate the hypothesis that arboreal *Aneides* salamanders have novel tooth functions. *Dental Dynamics* provides a new and fast way to measure teeth and increases the accessibility of the functional homodonty method. We hope *Dental Dynamics* will encourage further theoretical and methodological development for quantifying and studying teeth.

Link: <https://academic.oup.com/iob/article/6/1/obae015/7668472>

Summary

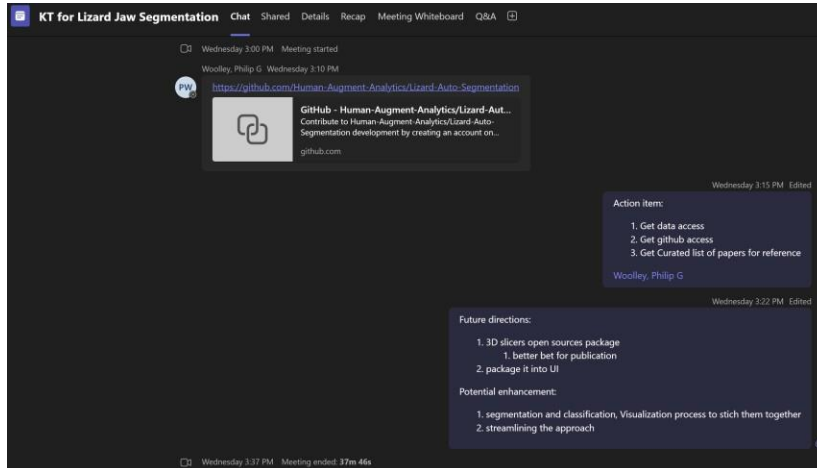
The paper shows a novel module named Dental Dynamics for 3D Slicer software to more quickly and accurately quantify tooth and jaw biomechanics. The tool automates calculation of key dental traits such as aspect ratio, mechanical advantage, and force transmission. The module was tested on teeth data from salamander species to show if they exhibit novel dental functions. The study demonstrated that different teeth shapes and sizes can result based on different methods, such as regionalization of stress in the jaw.

The paper is important to our research since the module presents a reference to how our module can and should work for jaw segmentation.

What did you do and prove it

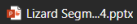
I focused on understanding the overall progress of the project up to now and getting properly onboarded. I began reviewing literature, documentation, and resources needed for advancing the project, such as Morphosource and previous researcher's Github repository.




Proof of meetings




Proof of getting access to literature

Paper list, presentation, and data access instructions Red category



 Zhong, Ming
To:  Woolley, Philip G;  Tian, Shuyu
Thu 1/16/2025 10:10 PM

Hi .





Thanks. By the way, I signed up for the meeting manager role. So I will keep records (captures attendees, agenda, transcript, recording) for the meetings going forward.

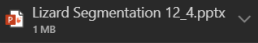
Best,
Ming

...

Sounds good, thanks! Great, thanks for letting me know! Good. Thanks.

Reply Reply all Forward

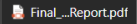
 Woolley,  G
To:  Zhong, Ming;  Tian, Shuyu
Thu 1/16/2025 12:32 PM




 1 MB


Hi Ming and Shuyu,

Here is the information that I promised from the meeting yesterday.

Knowledge sharing regarding lizard segment project



 Zhong, Ming
To:  Woolley, Philip G;  Tian, Shuyu
Wed 1/15/2025 11:39 AM

Hi .





Could u pls send out the meeting invite?

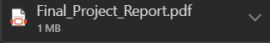
Steven

...


Yes, will do. Done! Sending it now.

Reply Reply all Forward

 Woolley,  G
To:  Tian, Shuyu;  Zhong, Ming
Tue 1/14/2025 9:01 PM

 1 MB

Here is the final report I wrote for the work from last semester, if you have time to skim through we can go over the details tomorrow.

Best,


Proof of getting access to MorphoSource

The screenshot shows the MorphoSource user dashboard for Shuyu Tian. The top navigation bar includes the MorphoSource logo, the user name 'Shuyu Tian', and a 'Browse' dropdown menu. The left sidebar contains navigation options: USER (Profile, Become A Contributor, Notifications), MY DOWNLOADS (Media Cart, Requests For Media, Previous Downloads), and MY MEDIA (Media And Objects). The main content area features a welcome message and two columns of actions. The 'Standard Actions' column includes links for 'View my media cart', 'View my pending requests to download media', 'Edit my user profile', 'Change my password', 'New media list', and 'My media lists'. The 'Become A Contributor' column contains a detailed text block explaining the requirements for becoming a contributor.

Standard Actions

- [View my media cart](#)
- [View my pending requests to download media](#)
- [Edit my user profile](#)
- [Change my password](#)
- [New media list](#)
- [My media lists](#)

Become A Contributor

In order to upload media, participate in projects and teams, or act as data manager for media that are shared with or transferred to you, you must first request contributor status. Visit [Become A Contributor](#) and supply a few details about the media you intend to contribute to MorphoSource or your reason for applying to be a project member or data manager. An administrator will check your application, and you will either be approved or hear back with additional questions or instructions presently. Thank you!

Proof of getting access to Github repository

The screenshot displays a Github repository page for 'Human-Augment-Analytics / Lizard-Auto-Segmentation'. The repository is public and was generated from 'Human-Augment-Analytics/HAAG-Code-Base-Template'. The page shows navigation tabs for Code, Issues, Pull requests, Actions, Projects, Security, and Insights. The 'Code' tab is active, showing a file browser for the 'main' branch. The repository has 1 branch and 0 tags. A search bar is present with the text 'Go to file'. The file list includes folders like 'Data', 'Example - Automated Tag Reading', 'Example - Calculate Repository Contributions', and 'Model', as well as files like '.gitignore', '1.0.0', and 'DataPreprocess.ipynb'. The most recent commit is by PhilipGMWoolley, dated last month, with 4 commits in total.

Human-Augment-Analytics / Lizard-Auto-Segmentation Public

generated from [Human-Augment-Analytics/HAAG-Code-Base-Template](#)

[Code](#) [Issues](#) [Pull requests](#) [Actions](#) [Projects](#) [Security](#) [Insights](#)

[main](#) [1 Branch](#) [0 Tags](#) [Code](#)

File/Folder	Commit Message	Commit Date
Data	Code updates for end of semester. Adding Final Project repo...	last month
Example - Automated Tag Reading	Initial commit	4 months ago
Example - Calculate Repository Contributions	Initial commit	4 months ago
Model	Code updates for end of semester. Adding Final Project repo...	last month
.gitignore	Code updates for end of semester. Adding Final Project repo...	last month
1.0.0	Code updates for end of semester. Adding Final Project repo...	last month
DataPreprocess.ipynb	Code updates for end of semester. Adding Final Project repo...	last month