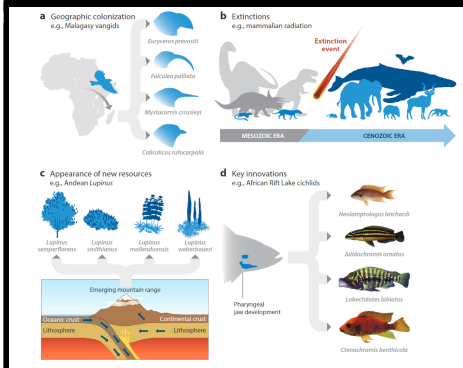
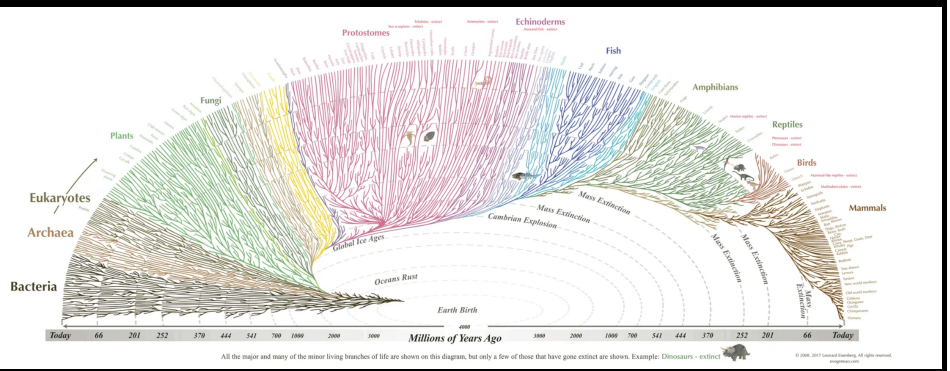
Thesis
Biodiversity Visualization in the Course of Time

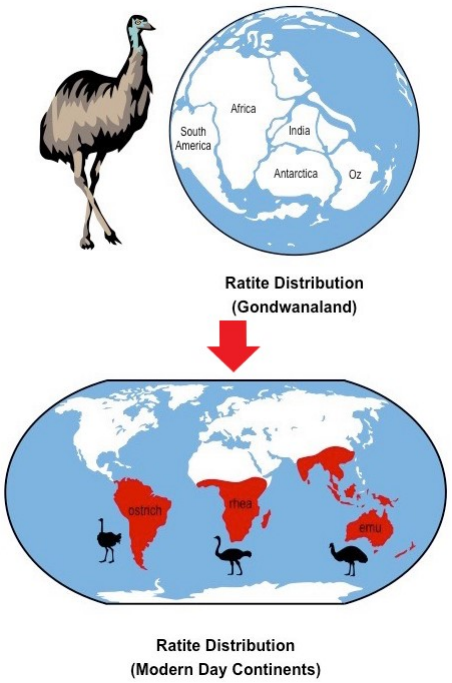
University of Zurich[UZH]





Introduction

Since the initial formation of our planet approximately 4.5 billion years ago, earth has undergone drastic changes. The first life is currently though to have appeared approximately 3.5 billion years ago, which, through the process of evolution, has differentiated into a tremendous amount of taxonomic diversity and a wide variety of organisms. However, this process has not been a linear, since evolution is naturally influenced by outside factors such as climate, plate tectonics and unique events. As such, it is observed that phases of mass-extinction (decrease of biodiversity) are often followed by phases radiation (increase of biodiversity in a clade) of a new clade [2, 3]. A well-known example of such an event would be the Cretaceous-Tertiary mass-extinction which terminated the domination of reptiles (e.g. dinosaurs) and lead to the radiation of mammals who had an evolutionary advantage in the cooling environment of that epoch due to their fur.



Ratite species distribution in the modern world caused by tectonic plate motion. [1]

Assignment

In this thesis / project, you goal is to implement a web application which allows the user to visualize and investigate this "course of the world" in regards to its biodiversity. The final visualization should allow the user to scrub through the 4.5 billion years, see the tectonic constellation as well as the corresponding biodiversity based on a dynamic tree of life visualization. Additional interactions of investigating the current view can be established resulting in a rich visualization of how life evolved though time and space on our planet.

In the course of action, you will have to go through a complete data visualization workflow, starting with the data cleaning and aggregation, storing the data in a suitable setup such as a database, and finally implementing a visualization web application which allows the interactive exploration of the biodiversity through the geological ages.
The initial dataset is provided, but additional data may be added during the project to enrich the visualization, such as climate data, special unique events, more species, etc.

Project Type

This project can be a bachelor thesis or master thesis through adjusting the tasks and goals.

Requirements

The implementation will be in Python for the data processing and the backend (in Flask) of the visualization. Preferably you have taken the courses Data Visualization Concepts (or/and) Data Visualization Analysis. The frontend will be implemented in JavaScript. Fluency in Python is a must, prior knowledge of fundamental Python libraries (Pandas, NumPy etc.) is helpful but can be learned during the project. Different technologies can be discussed.

Work Load

- 20% Theory
- 60% Implementation
- 20% Test

Supervision

Prof. Dr. Renato Pajarola
Gaudenz Halter (assistant)

Contact

Write an Email to halter@ifi.uzh.ch to have a chat about the project if you are interested.

References

[1] Florian Maderspacher. Evolution: Flight of the ratites. *Current Biology*, 27(3):110–113, 2017.

[2] James T. Stroud and Jonathan B. Losos. Ecological opportunity and adaptive radiation. *Annual Review of Ecology, Evolution, and Systematics*, 47(1):507–532, 2016.

[3] Ay Zhuravlev and Robert Riding. The ecology of the cambrian radiation. *Eos*, 82(24), 2001.

VISUALIZATIONAND MULTIMEDIALAB

Professor Dr. Renato Pajarola
Visualization and Multimedia Lab
Department of Informatics
University of Zurich