14th, April 2022 https://blutjens.github.io/

UROP || Tackling Climate Change with AI || Creating Fast High-Resolution Climate Projections with Physics-Informed Diffusion-based Models

Supervisor: Björn Lütjens, HSL, AeroAstro, PhD. Candidate
PI: Dr. Chris Hill, EAPS, Principal Research Engineer
Compensation: Paid; 40hrs/wk, Summer term 2022

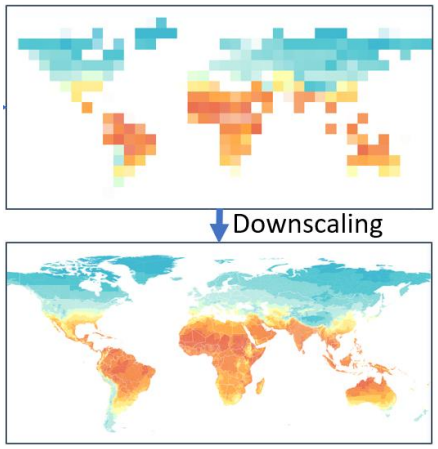

Fig. 1 The UROP will use superresolution methods to create high-resolution climate projections

Climate models can be unwieldy beasts of compute. Simulating a year of climate at 1km resolution can take up to two weeks on a 5000 GPU node supercomputer and if being powered by fossil fuels emit two railcars worth of coal. Because of the computational expense climate models are often run at medium resolution of 10-100km. Novel methods from 'dynamical downscaling' then run weather models to increase the resolution 1km, but are still computationally expensive to run.

This project aims to increase the resolution of climate projections via novel fast machine learning methods. Specifically, the UROP will research novel superresolution methods such generative adversarial networks (GANs), normalizing flows, and diffusion-based models. The UROP will preprocess an existing dataset that combines low-resolution CMIP6 with high-resolution WRF data, apply a superresolution method, and validate the models.

Preferred, but not necessary qualifications:

- Passion for climate issues
- Familiarity with deep learning libraries, ideally in computer vision, e.g., pytorch, tensorflow.
- Familiarity with climate and/or weather data processing, e.g., CMIP6, WRF, NCAR CESM
- General understanding of Atmospheric Sciences
- Collaborative spirit
- Very optional, but fun if there‘s experience in large-scale geospatial data proccessing in python with, e.g., xarray, pandas, rasterio, UI/UX, web development, climate policy

We strongly value an environment of inclusion, support, and collaboration and highly encourage students from historically excluded groups to apply. The research will be with our team at the Earth, Atmosphere, and Planetary Sciences Department with Dr. Chris Hill and Human Systems Laboratory, Dept. of AeroAstro and can be virtual. If you’re interested please feel free to email me until 04/17 with a CV and two paragraphs about your interest, experience, and long-term goals at lutjens [at] mit [dot] edu .

Thank you,

Björn Lütjens