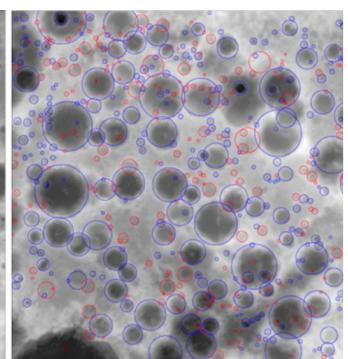
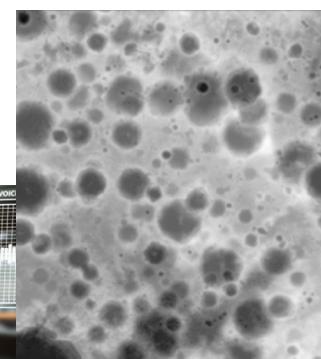


Integrating Machine Learning into Geographic Research

Introduction to GeoAI

Machine Learning and Artificial Intelligence

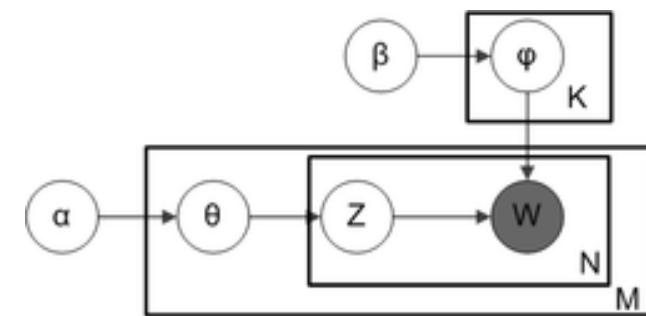
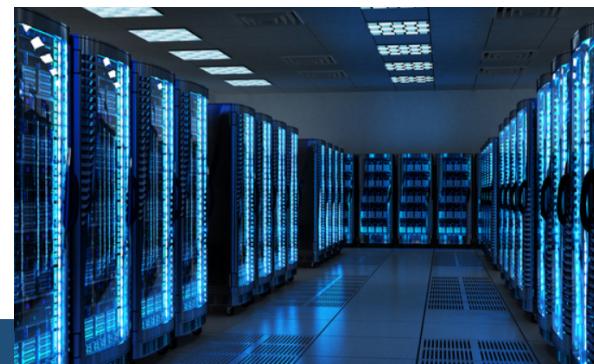
- Artificial Intelligence (AI) has received a lot of attention in recent years from academia, industry, and the public media



Machine Learning and Artificial Intelligence

- Despite its recent popularity, the study of AI as a field started back in **1950s**
- Recent advancements in machine learning and AI are due to three major factors: **big data**, **high performance computers**, and advanced ML models

BIG DATA



Fast advancements of AI since 21st century, especially after 2010

- **Big data:** smart devices and sensors enable the recording of various types of information



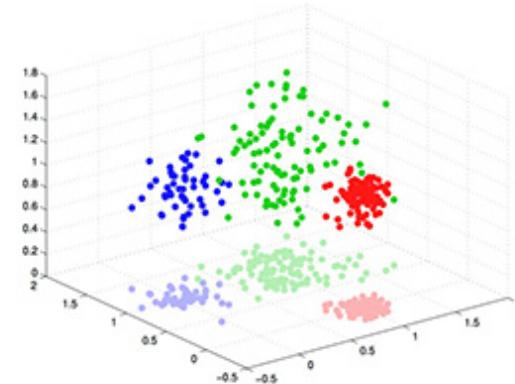
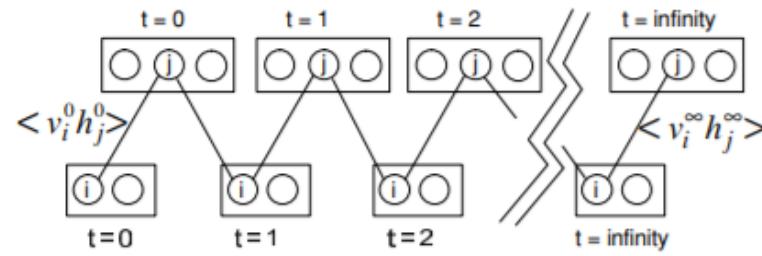
Fast advancements of AI since 21st century, especially after 2010

- High performance computing: servers on the cloud; powerful personal computers



Fast advancements of AI since 21st century, especially after 2010

- New and improved computational models
 - New models: AlexNet, GoogLeNet, ResNet,
 - Various improvements on classic models: random forest, support vector machine, density-based clustering, ...

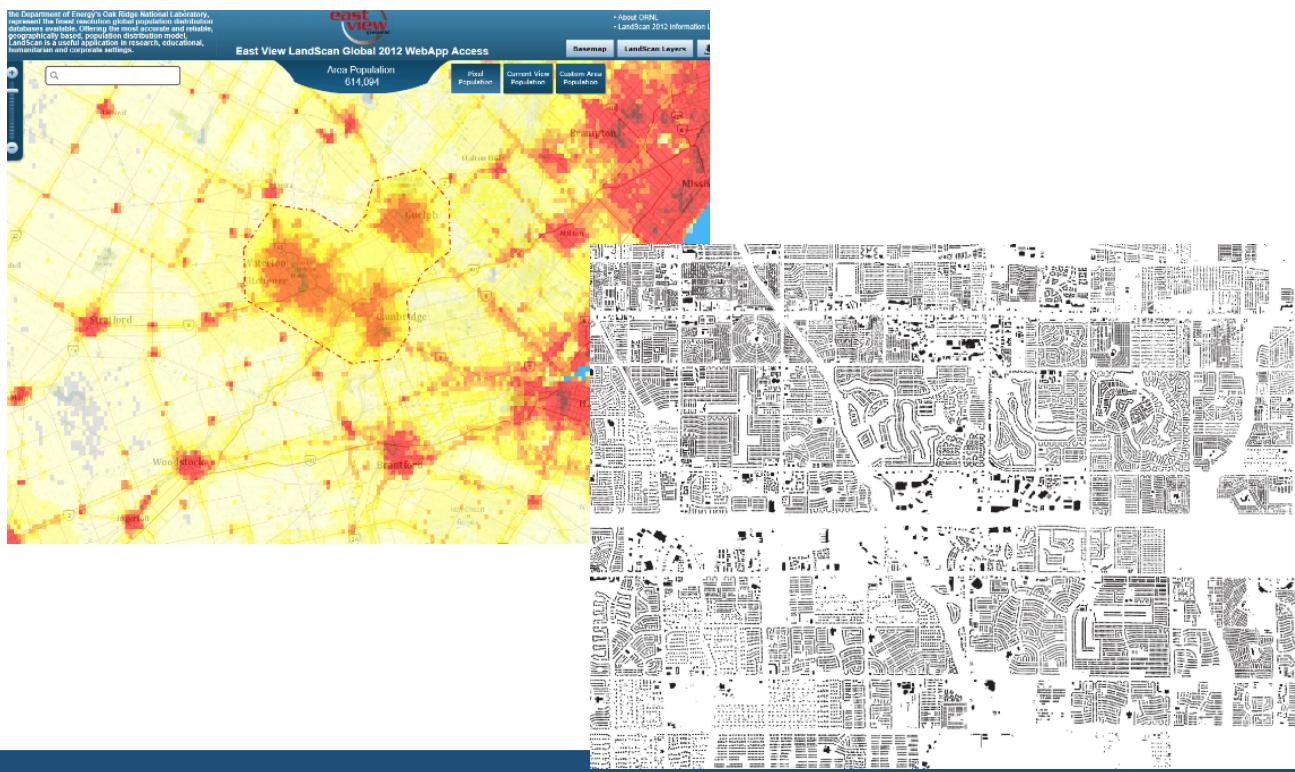


GeoAI: the integration of AI and geography



GeoAI: the integration of AI and geography

- Why does GeoAI emerge?
- Big data: a lot of today's big data have geographic locations attached to it



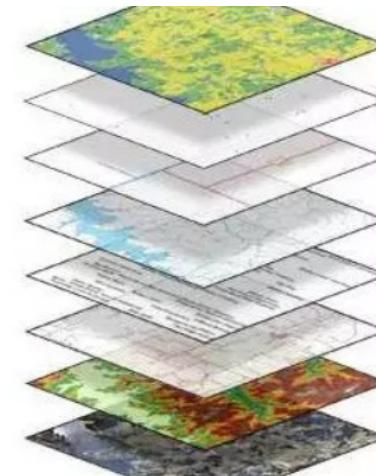
GeoAI: the integration of AI and geography

- Why does GeoAI emerge?
- High performance computing: there have already been a lot of studies on integrating GIS (geographic information systems) with supercomputers and cyberinfrastructures

The screenshot shows a journal article page from Taylor & Francis Online. At the top, there's a blue header bar with the Taylor & Francis logo and a 'Log in' button. Below the header, the journal title 'Annals of the Association of American Geographers' is displayed, along with its volume ('Volume 100, 2010 - Issue 3'). A search bar is also present. On the left side, there's a sidebar with metrics: '1,028 Views' and '133 CrossRef citations to date'. The main content area features the title 'A CyberGIS Framework for the Synthesis of Cyberinfrastructure, GIS, and Spatial Analysis' by Shaowen Wang, with publication details: 'Pages 535-557 | Received 01 Jul 2009, Accepted 01 Nov 2009, Published online: 19 May 2010'. It also includes download and citation links.

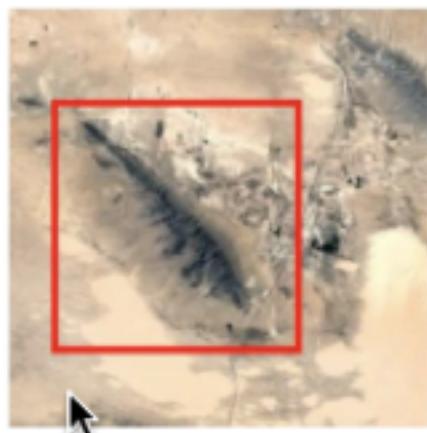
GeoAI: the integration of AI and geography

- Why does GeoAI emerge?
- New and improved algorithms: geographic location is often the only key for integrating the heterogeneous input data of many AI models
 - Population
 - Land use and land cover types
 - Building footprints
 - Remote sensing images
 - Geotagged messages and texts
 - ...



Some GeoAI Applications

- Detecting geographic objects from remote sensing images



(a) Hill



(b) Impact crater



(c) Meander



(d) Volcano

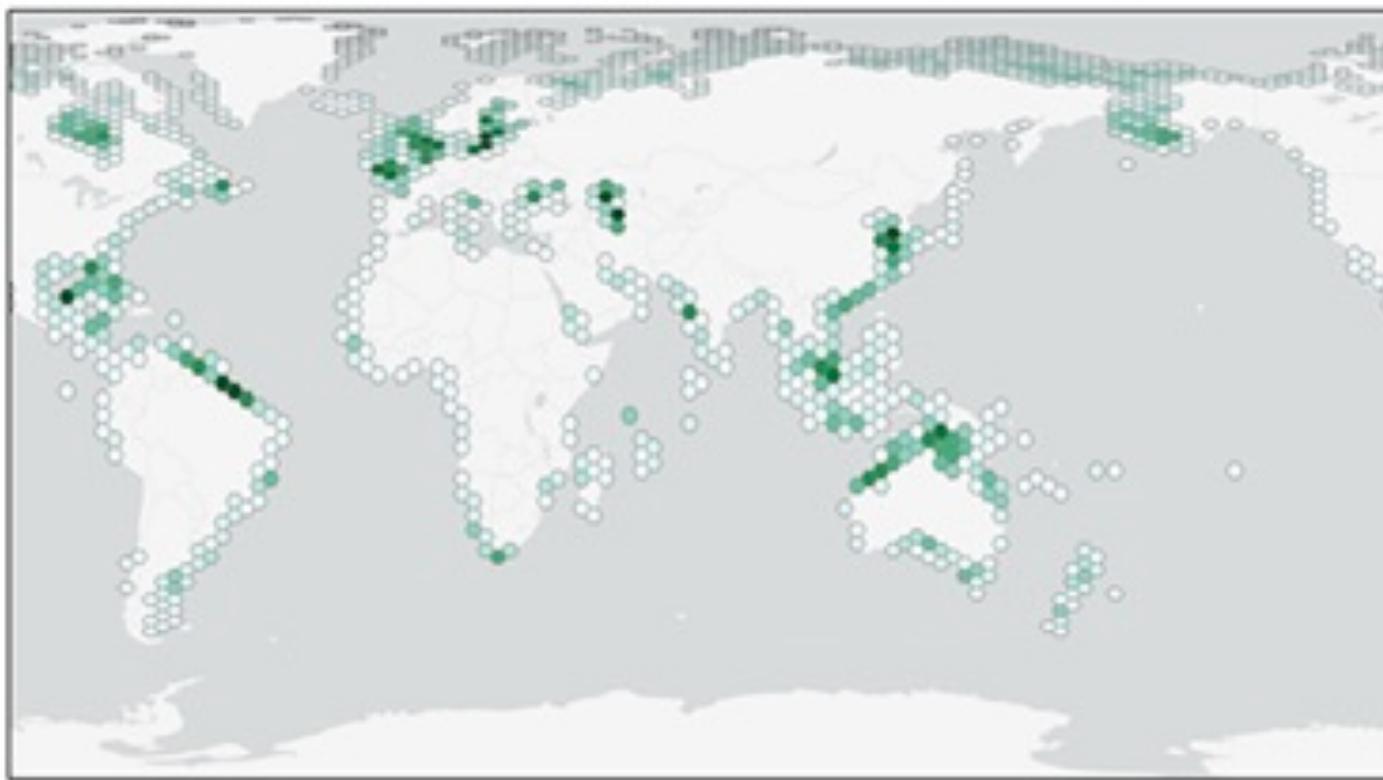
Some GeoAI Applications

- Classifying land cover types



Some GeoAI Applications

- Predicting locations of seagrass habitats



Our Workshop

- Explore the basic concepts of machine learning
- How to use Python and GeoPandas to process geospatial data
- How to build machine learning models on Google Colab with scikit-learn
- Build a ML model yourself on Google Colab to make predictions