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Research Introduction

Yifan Yang

Spatial Sciences Institute

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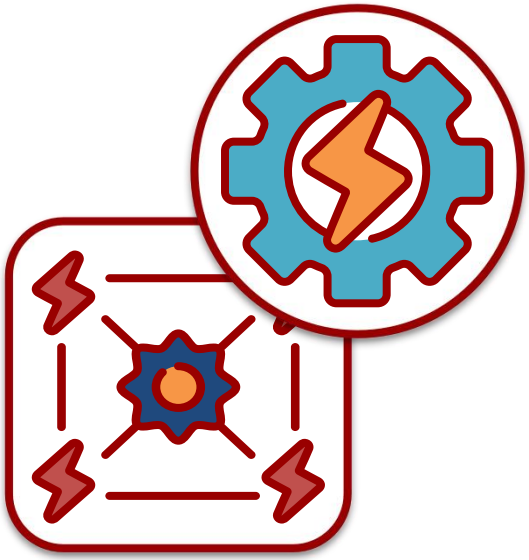


Self Introduction

University of Southern California
Master of Science, Spatial Data Science — Expected May 2024

Hainan University
Bachelor of Engineering, Software Engineering — September 2018 - June 2022

research interests

1. Spatial Science and Data Science based on people, place, health, public opinion, etc.

2. Ecosystem services, environmental health, urban science

3. LLMs and LMMs on geography, GeoAI, Machine learning and deep learning

Applications: Esri ArcGIS Pro, Microsoft Office Suite, MS Access, MS SQL Server, SQL Server Management Studio, PgAdmin, PostgreSQL & PostGIS, Visual Studio Code, Google Colaboratory

Programming: ArcGIS API (JavaScript, Python), JavaScript, C, C++, JAVA, Python, SQL

Introduction to current research

Attention: Large Multimodal Model is Watching your Geo-privacy
（https://arxiv.org/abs/2311.13018）

First author : Yang Yifan, Advisor: Prof. Siqin Wang

American Association of Geographers Annual Meeting， April 16 - 20, 2024，Honolulu, Hawai’i

Background: Geographic privacy (geo-privacy) concerns keeping one's location private, especially from personal electronic devices. This aspect of security is often overlooked.

Challenge: With the rise of Large Multimodal Models (LMM) like GPT-4 in Open Source Intelligence (OSINT), risks of geo-privacy breaches have increased.

Study: Developed "GeoLocator," a GPT-4 based model, to detect locational information in images and social media content.

Findings: GeoLocator can accurately infer specific geographic details, posing a risk of unintentional public exposure of geospatial information.

Implications: Highlights the threats of online data sharing and advanced AI technologies to geo-privacy. Emphasizes the need for increased awareness and protective measures against geo-privacy leakage.

Images	Address Category	Search Engine	GPT-4	Dr. Watson	Distances*
	Country	✓	✓	✓	*17.73 ft*
	State	✓	✓	✓	
	City/ Town	✗	✓	✓	
	Street	✗	✗	✓	
	Country	✓	✗	✓	*10 miles*
	State	✓	✗	✓	
	City/ Town	✓	✗	✓	
	Street	✗	✗	✗	
	Country	✓	✗	✓	*32.49 miles*
	State	✓	✗	✗	
	City/ Town	✗	✗	✗	
	Street	✗	✗	✗	
	Country	✓	✗	✓	*126.42 miles*
	State	✗	✗	✗	
	City/ Town	✗	✗	✗	
	Street	✗	✗	✗	
	Country	✓	✗	✓	*23 ft*
	State	✓	✗	✓	
	City/ Town	✓	✗	✓	
	Street	✓	✗	✓	

Urban Tree Initiative--urban tree shade model

Instructor: Prof. John Wilson, Prof.Yi Qi, Beau MacDonald GIS Project Specialist

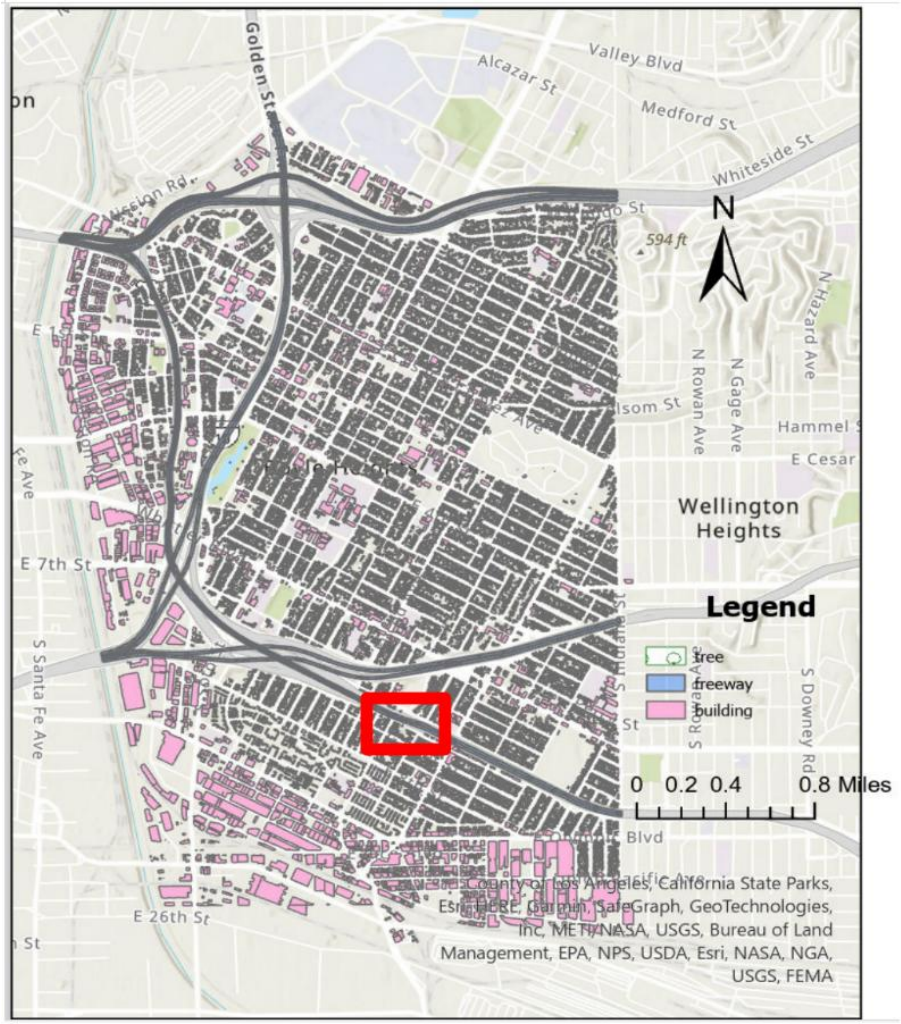
Platform: shade analysis tools and 3D models in ArcGIS Pro

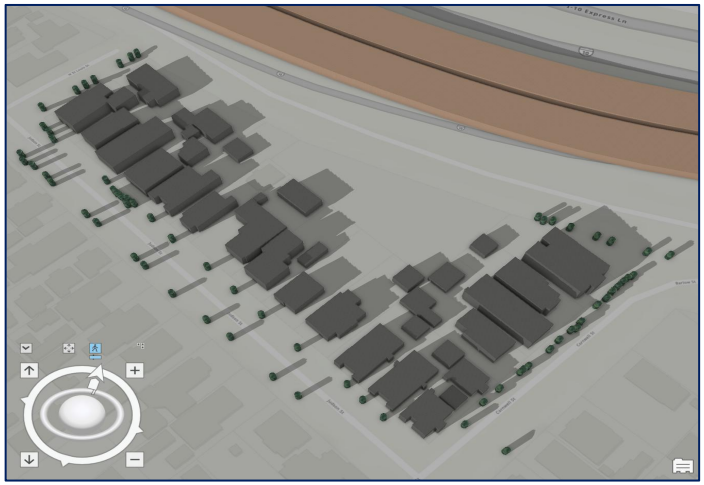
1. Construct DEM and DSM Using LiDAR Data
Employ LiDAR data to create Digital Elevation Models (DEM) and Digital Surface Models (DSM), accurately mapping terrain and surface features

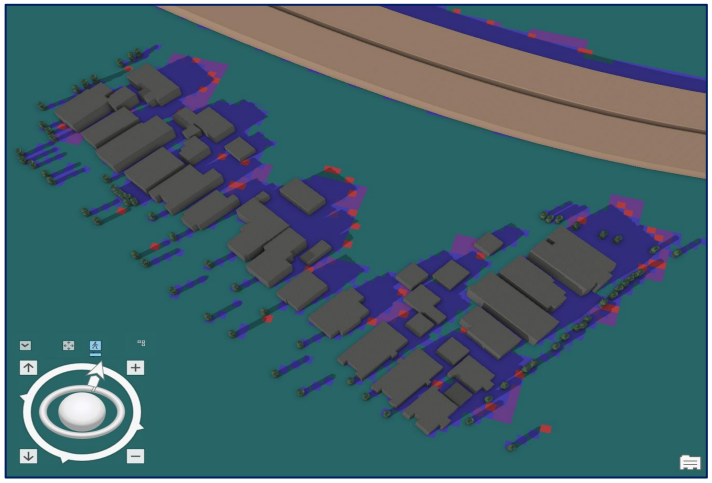
2. Build 3D Models for Buildings and Trees
Combine surface features and elevation data to develop 3D models

3. **Calculate Shadow Area Using Sun Shadow Frequency**
Apply sun shadow frequency analysis to quantify the shadow areas of freeways, buildings, and trees accurately

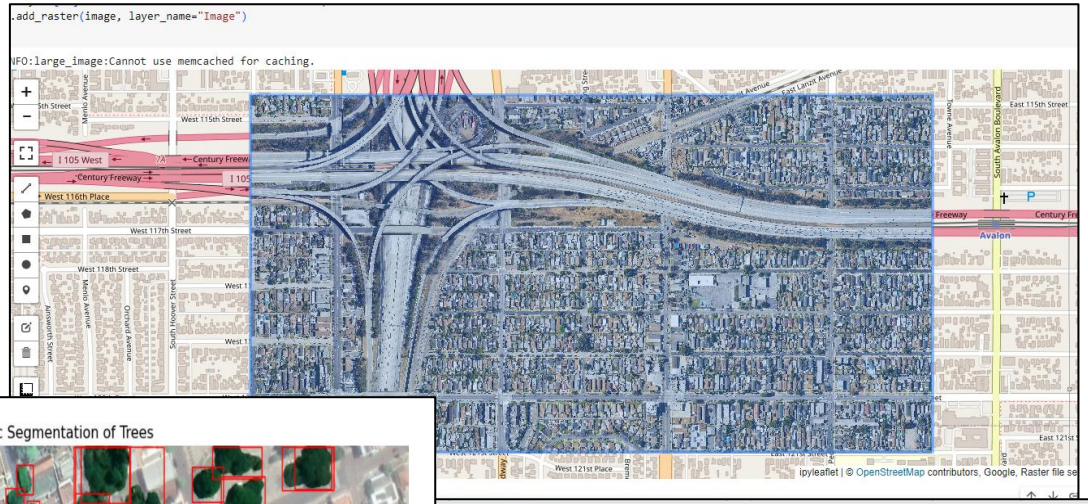
4. **Determine the Urban Tree Shade Coverage**
Calculate the shade area contributed by urban trees to determine the urban tree shade coverage

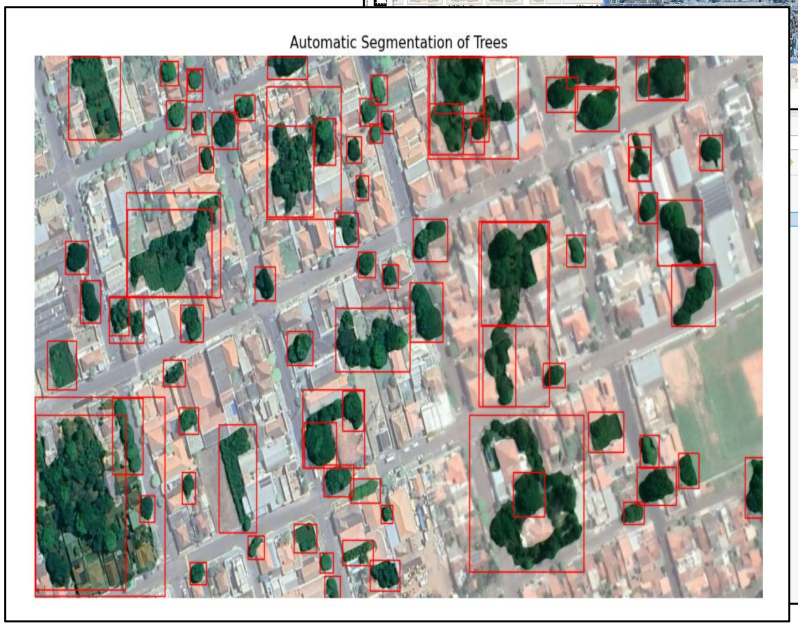

Valley Blvd
Alcazar St
Medford St
Whiteside St
Golden St
N
594 ft
N Rowan Ave
N Gage Ave
N Hazard Ave
Hammel St
E Cesar
Wellington Heights
E 7th St
S Santa Fe Ave
S Downey Rd
Legend
tree
freeway
building
0 0.2 0.4 0.8 Miles
E 26th St
County of Los Angeles, California State Parks, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, Esri, NASA, NGA, USGS, FEMA

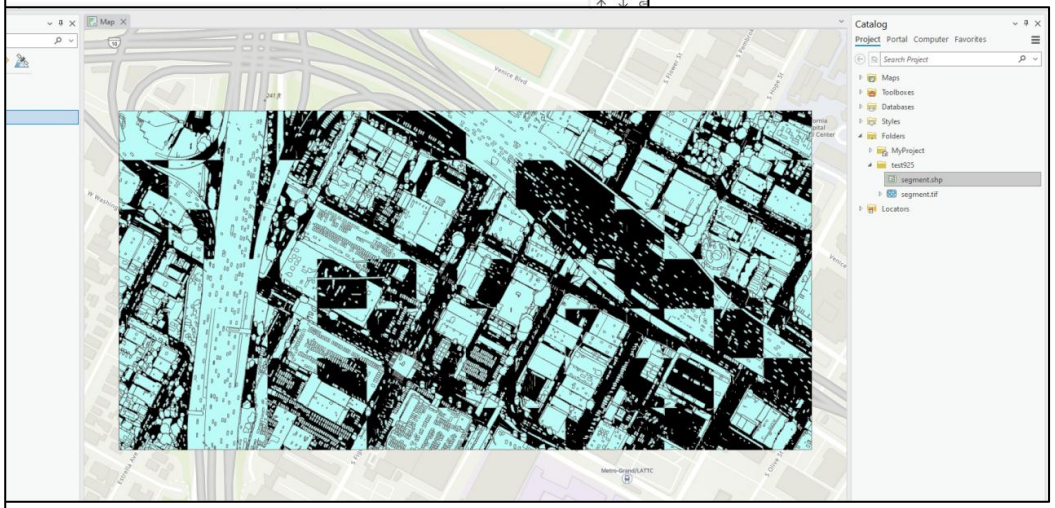




Segment Anything Model (SAM) vs CNN vs GPT-4







Seeing from reading: How well does GPT comprehend remote sensing images?

Background: Remote sensing technology plays an important role in multiple fields by capturing earth data (mainly aerial or satellite images) over long distances. Traditionally, remote sensing image interpretation requires extensive manual input and expertise.

New trends: The current trend is to develop models that can demonstrate stronger generalization capabilities, such as large pre-trained models. For example, GPT-4 introduced image understanding capabilities in November 2023, bringing significant progress to multi-modal generative AI.

Research Methods This study adopts dual methods of qualitative (such as instance-related experiments) and quantitative (such as image captioning experiments) to evaluate GPT-4's ability to parse remote sensing images.

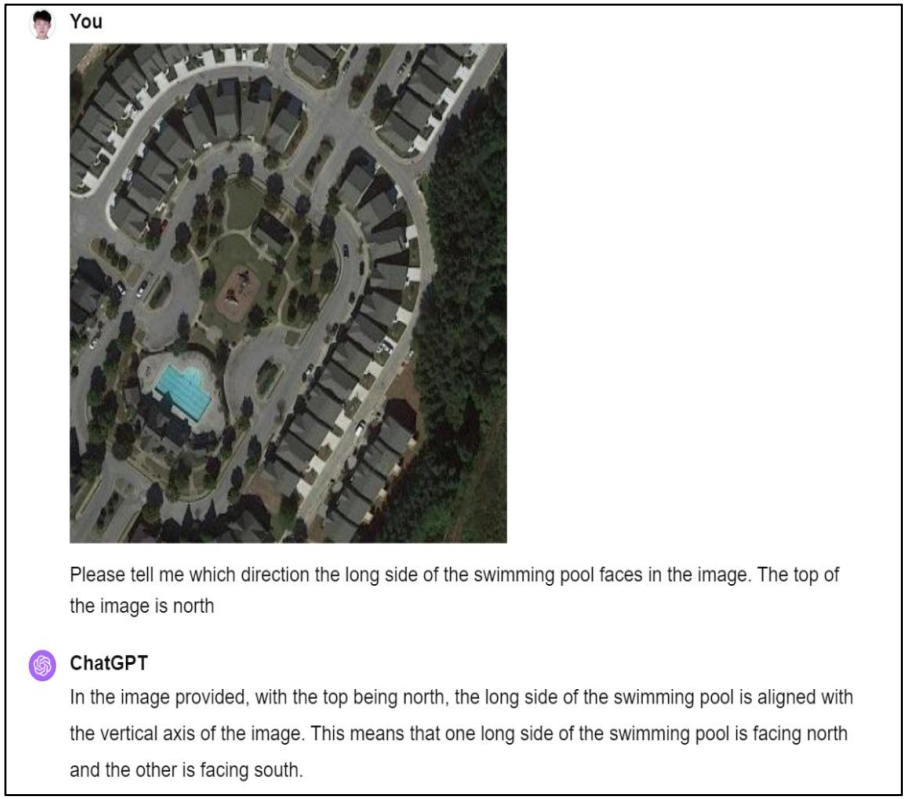
Research purpose: Mainly explore the ability of the GPT-4 model in parsing remote sensing images, including tasks such as instance presence, counting, coverage estimation, relative positioning estimation, direction identification, and change detection.

Prompt template

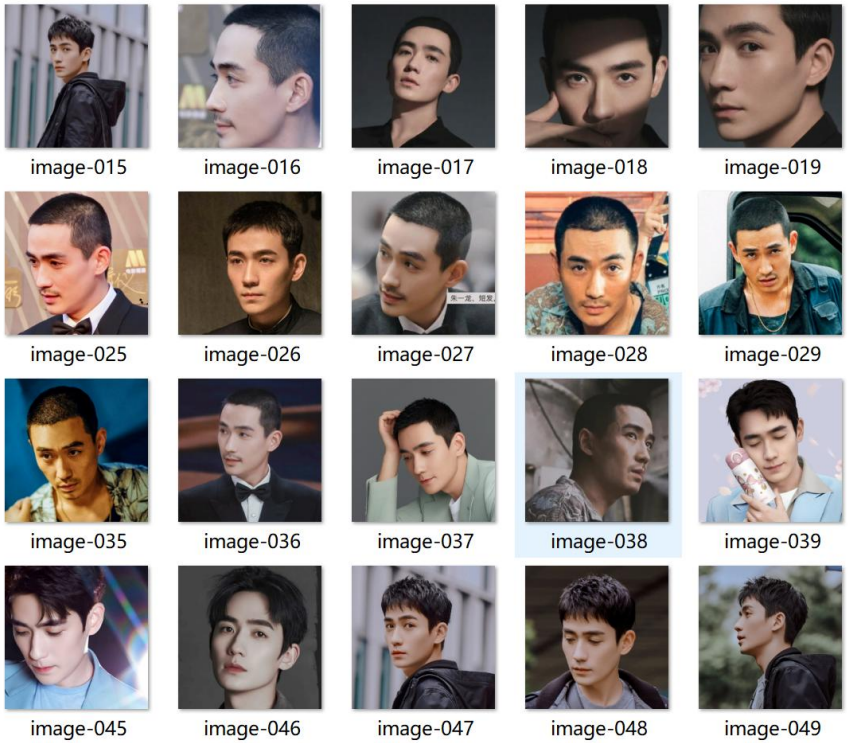
Please tell me the direction of the xxx in the image. The top of the image is north.

Please tell me which direction the xxx is facing in the image. The top of the image is north. Try to tell me the answer through the eight cardinal directions and try to answer the biased angle.

Please tell me the direction of xxx in the picture. The top of the image is north. Establish a plane Cartesian coordinate system from the center of this picture. First tell where the xxx is located in the picture.



Past research experience



Internship experience
Generative AI, large model fine-tuning.
Fine-tune Stable diffusion models using user-supplied datasets, using dreambooth, lora, etc.
Dataset pre-processing
Large model fine-tuning
Training and testing various configurations and parameters in ML applications
Experience working in the cloud (AWS)

Past research experience

Yifan Yang

FOLLOWING

University of Southern California
Verified email at usc.edu - Homepage

machine learning geospatial data science GeoAI spatial analysis

TITLE	CITED BY	YEAR
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COVID-19 Public Opinion and Emotion Monitoring System Based on Time Series Thermal New Word Mining NX Yixian Zhang, Jieren Cheng, Yifan Yang, Haocheng Li, Xinyi Zheng, Xi Chen ... Computers, Materials & Continua 64 (3)	21 *	2020
Attention: Large Multimodal Model is Watching your Geo-privacy Y Yang, Y Zhang, D Li, S Sun, J Duan, J He, Q Wu, H Liu arXiv preprint arXiv:2311.13018		2023
Different Loss Functions Used in the Low-rank Approximation C Shi, G Mou, H Wang, T Liu, Y Yang, Z Li International Core Journal of Engineering 6 (11), 360-368		2020

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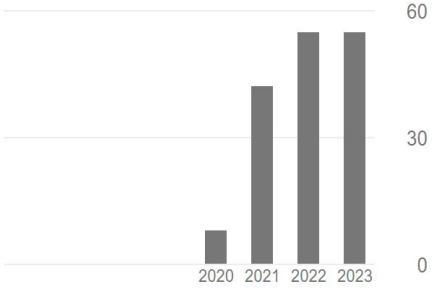

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Research Name:
Experiments of Federated Learning for COVID-19 Chest X-ray Images.

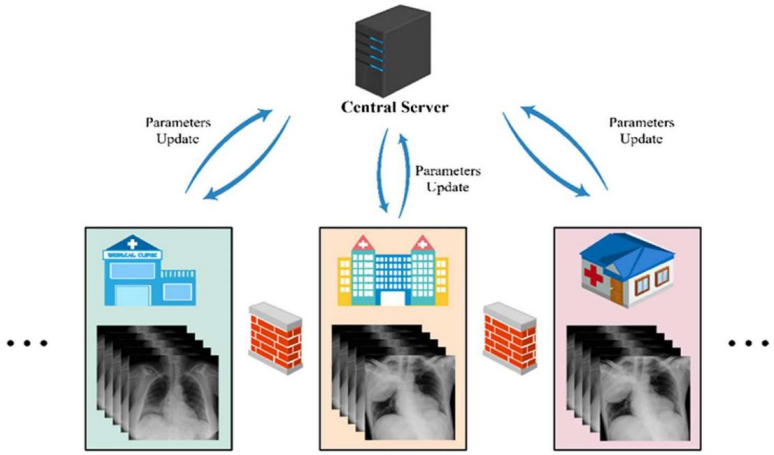
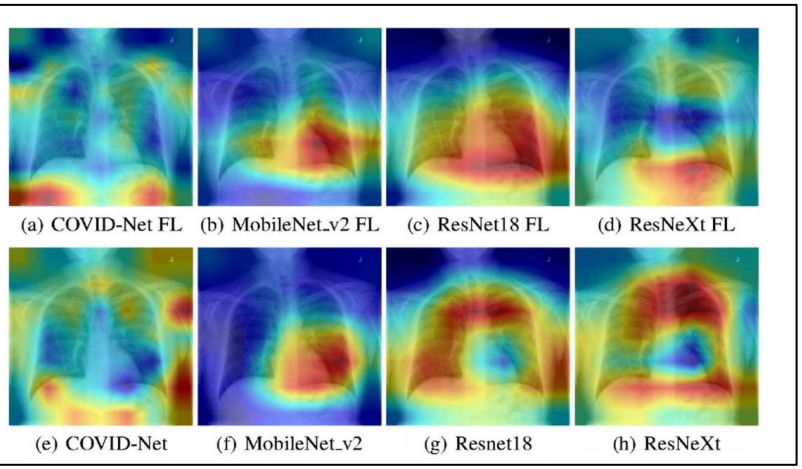
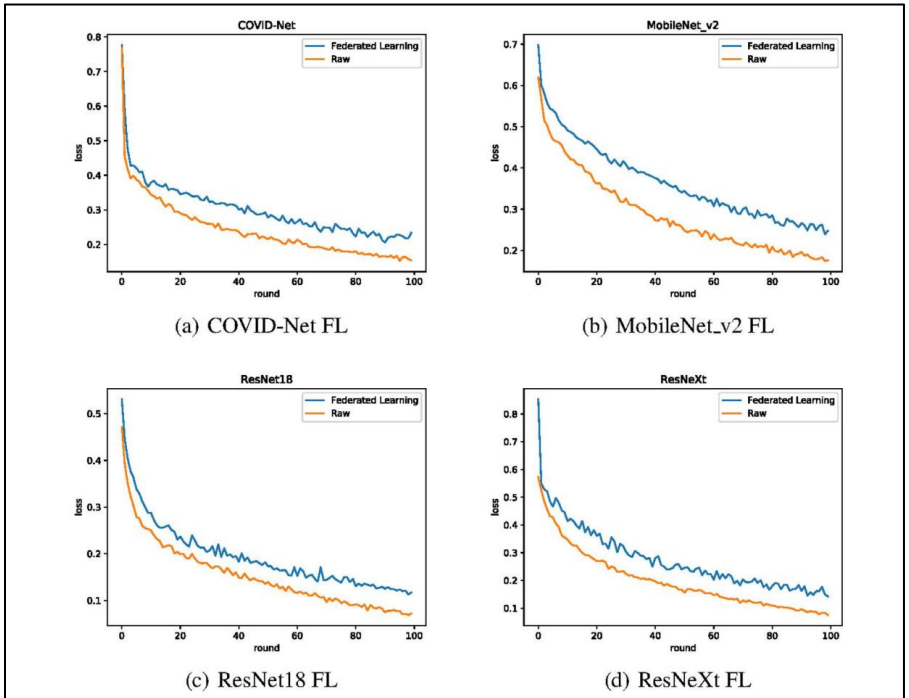


Fig. 1. Federated learning framework for COVID-19 CXR images



(a) COVID-Net FL (b) MobileNet_v2 FL (c) ResNet18 FL (d) ResNeXt FL

(e) COVID-Net (f) MobileNet_v2 (g) Resnet18 (h) ResNeXt



(a) COVID-Net FL (b) MobileNet_v2 FL

(c) ResNet18 FL (d) ResNeXt FL

Fig. 5. Loss convergence speed comparison of whether to use the federated learning framework

Research:
COVID-19 Public Opinion and Emotion Monitoring System Based on Time Series Thermal New Word Mining