Project Log

Course Syllabus: AI for Social Sciences and Humanities

Instructors:

Format:

1. **Google Colab:** Convenient for code reproduction, code sharing, simple environment configuration, and URL sharing.

   https://colab.research.google.com/?utm_source=scs-index#scrollTo=GJBs_flRovLc

2. **Github:** Students may be required to apply for a GitHub account, which allows them to perform operations such as fork, code management, and learning.

   https://github.com/

3. **Hugging Face:** Use models available on Hugging Face. Students will learn how to download, configure, and use these models on GitHub and conduct experiments in Colab.

   https://huggingface.co/openbmb/MiniCPM-Llama3-V-2_5

Course Schedule: Assuming two lectures and one lab session per week.

Weeks 1-3: Introduction to Basic AI Content

Week 1: Introduction to AI in Social Sciences and Humanities

- **Description:** This week provides an overview of AI, its relevance in social sciences and humanities, and introduces key concepts such as machine learning, neural networks, NLP, CV, LLMs, and generative AI.

- **Activities:** Lecture, discussion, case studies, interesting YouTube videos explaining AI development and application.

- **Lab 1:** Introduction to Colab and Basic Python for AI. Design a basic Python tutorial covering reading files, printing results, basic data structures, and package installation.

Course Outline

Lecture and Discussion Topics:

Overview of AI: Definitions and Historical Context

- Definitions of AI
- Brief history of AI development
- Key milestones in AI

Relevance of AI in Social Sciences and Humanities

- How AI is transforming social sciences and humanities
- Case studies of AI applications in these fields
- Addressing concerns and misconceptions about AI

Key Concepts in AI

- **Machine Learning (ML)**
    - Definition and examples
    - Supervised vs unsupervised learning
- **Neural Networks (NN)**
    - Basic structure and function
    - Types of neural networks (e.g., CNNs, RNNs)
- **Natural Language Processing (NLP)**
    - Key tasks in NLP (e.g., sentiment analysis, language translation)
- **Computer Vision (CV)**
    - Applications of CV (e.g., image recognition, facial recognition)
- **Large Language Models (LLMs)**
    - Examples like GPT-3 and BERT
    - Capabilities and limitations
- **Generative AI (AGI)**
    - Definition and examples (e.g., DALL-E, GANs)
    - Potential and challenges

Why AI Matters in Social Sciences and Humanities

- Importance of understanding AI for social science students
- Simplifying AI concepts to reduce fear and misconceptions
- Examples of impactful AI projects in social sciences and humanities

Recommended Reading and Assignments

Kang, Y., Gao, S., & Roth, R. E. (2024). Artificial intelligence studies in cartography: a review and synthesis of methods, applications, and ethics. Cartography and Geographic Information Science, 1-32.

Heilinger, J. C. (2022). The ethics of AI ethics. A constructive critique. Philosophy & Technology, 35(3), 61.

Jung, J.-K. (2013). Critical GIS Twenty Years After Friday Harbor Meeting: Critical Intervention to Epistemology, Ontology, Methodology, and the Social Implication of GIS. Journal of the Association of Korean Geographers, 2(2), 199–215. https://doi.org/10.25202/JAKG.2.2.6 (From critical GIS to critical GeoAI, we can draw on some perspectives of critiques from this article)

Ash, J., Kitchin, R., & Leszczynski, A. (2018). Digital turn, digital geographies?. Progress in Human Geography, 42(1), 25-43.

Extended Readings:

Elwood, S. (2022). Toward a fourth generation critical GIS: Extraordinary politics. ACME: An International Journal for Critical Geographies, 21(4), 436-447. (How GeoAI confronts social, political, epistemological violences that are frighteningly consistent across time and space, even as their digital and data techniques have shifted)

Nelson, T. A., Goodchild, M. F., & Wright, D. J. (2022). Accelerating ethics, empathy, and equity in geographic information science. Proceedings of the National Academy of Sciences, 119(19), e2119967119.

Recommended course videos (in class or after class)

▶ Google's AI Course for Beginners (in 10 minutes)!

▶ 5 Mind-blowing Artificial Intelligence Tools 🎉

Week 2: Introduction to Data Science and AI for Social Science

- **Description:** This week covers the basics of data science, types of data, data sources, geospatial data, and the connection between geographical laws and data.

- **Activities:** Lecture on data collection techniques, data life cycle, data websites, and tutorials on web crawlers.

- **Lab 2:** Cleaning and preparing a social media dataset using Pandas, including data preprocessing and geolocation inference.

Course Outline

Lecture and Discussion Topics:

Basics of Data Science

- Definition and importance of data science
- Key concepts and processes in data science
- Role of data science in social sciences

Types of Data

- Structured vs unstructured data
- Quantitative vs qualitative data
- Examples of different data types in social sciences

Data Sources

- Primary vs secondary data sources
- Common data sources for social sciences (e.g., surveys, social media, public datasets)
- Introduction to geospatial data and its significance

Geospatial Data and Geographical Laws

- Definition and examples of geospatial data
- Importance of geographical laws in data analysis
- Key geographical concepts (e.g., Tobler's First Law of Geography)

Web Crawlers and Web Scraping

- What is a web crawler?
- How web crawlers work
- Differences between web scraping and web crawling
- Ethical considerations and legal aspects

Data Collection Techniques

- Methods for collecting data
- Overview of the data life cycle (collection, storage, processing, analysis, sharing)
- Tools and websites for data collection

Recommended Reading and Assignments

Goodchild, M., Appelbaum, R., Crampton, J., Herbert, W., Janowicz, K., Kwan, M. P., ... & Langham, G. (2022). A white paper on locational information and the public interest.

Putting data back into context. Catherine, D. (2019). DataJournalism.Com. https://datajournalism.com/read/longreads/putting-data-back-into-context

Extended readings:

Zhang, S., Zhao, B., Tian, Y., & Chen, S. (2021). Stand with# StandingRock: Envisioning an epistemological shift in understanding geospatial big data in the "post-truth" era. Annals of the American Association of Geographers, 111(4), 1025-1045.

Recommended course videos (in class or after class)

▶ What is Web Crawler and How Does It Work?

▶ Web Scraping vs Web Crawling Explained

Week 3: Introduction to Machine Learning and Deep Learning Application

- **Description:** Focuses on supervised vs. unsupervised learning, key algorithms, deep learning basics, and evaluation metrics. Emphasis on practical applications in specific fields.

- **Activities:** Lecture on ML and DL concepts, practical examples.

- **Lab 3:** Implement and evaluate a simple ML model using open-source tools. Predicting housing prices and population migration patterns with Python libraries like Scikit-learn.

Course Outline

Lecture and Discussion Topics:

Introduction to Machine Learning (ML)

- Definition and importance of ML
- Overview of key ML concepts
- Differences between ML and traditional programming

Supervised vs. Unsupervised Learning

- Definitions and differences
- Examples of supervised learning (e.g., regression, classification)
- Examples of unsupervised learning (e.g., clustering, dimensionality reduction)

Key Algorithms in Machine Learning

- Supervised learning algorithms: Linear Regression, Decision Trees, Random Forests, Support Vector Machines (SVM)
- Unsupervised learning algorithms: K-means clustering, Principal Component Analysis (PCA)

Introduction to Deep Learning (DL)

- Definition and importance of DL
- Overview of neural networks
- Key deep learning architectures: Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), Generative Adversarial Networks (GANs)

Evaluation Metrics for ML and DL Models

- Accuracy, precision, recall, F1 score
- Mean squared error, R-squared
- Confusion matrix and ROC curve

Practical Applications of ML and DL in Specific Fields

- Applications in social sciences and humanities
- Case studies and examples

Recommended Reading and Assignments

Cheng, L., Varshney, K. R., & Liu, H. (2021). Socially responsible AI algorithms: Issues, purposes, and challenges. Journal of Artificial Intelligence Research, 71, 1137-1181.

Burrell, J., & Fourcade, M. (2021). The society of algorithms. Annual Review of Sociology, 47, 213-237.

Leszczynski, A. (2016). Speculative futures: Cities, data, and governance beyond smart urbanism. Environment and Planning A: Economy and Space, 48(9), 1691–1708. https://doi.org/10.1177/0308518X16651445

Recommended course videos (in class or after class)

▶ Machine Learning vs Deep Learning

▶ Supervised vs. Unsupervised Learning

[Machine Learning Specialization by Andrew Ng - YouTube](#)

Weeks 4-6: Visual and Language Models

Week 4: Introduction to Basic Natural Language Processing and Computer Vision in Social Science

- **Description:** Introduces the basics of NLP and CV, key algorithms, and their applications in social sciences.
- **Activities:** Lecture on NLP and CV basics, comprehensive lecture covering techniques and concepts.
- **Lab 4:** Sentiment analysis using NLTK and TextBlob, image processing and classification using OpenCV or PyTorch.

Course Outline

Lecture and Discussion Topics:

Introduction to Natural Language Processing (NLP)

- Definition and importance of NLP
- Key concepts and techniques in NLP
- Applications of NLP in social sciences

Key Algorithms in NLP

- Tokenization, stemming, and lemmatization
- Part-of-speech tagging and named entity recognition
- Sentiment analysis and text classification

Introduction to Computer Vision (CV)

- Definition and importance of CV
- Key concepts and techniques in CV
- Applications of CV in social sciences

Key Algorithms in Computer Vision

- Image preprocessing and augmentation
- Feature extraction and image classification
- Object detection and recognition

Practical Applications of NLP and CV in Social Sciences

- Case studies and examples
- Discussion on the impact and challenges

Recommended Reading and Assignments

Sit, M. A., Koylu, C., & Demir, I. (2020). Identifying disaster-related tweets and their semantic, spatial and temporal context using deep learning, natural language processing and spatial analysis: a case study of Hurricane Irma. In *Social Sensing and Big Data Computing for Disaster Management* (pp. 8-32). Routledge.

Hu, Y., Mao, H., & McKenzie, G. (2019). A natural language processing and geospatial clustering framework for harvesting local place names from geotagged housing advertisements. International Journal of Geographical Information Science, 33(4), 714-738.

Ghermandi, A., Depietri, Y., & Sinclair, M. (2022). In the AI of the beholder: A comparative analysis of computer vision-assisted characterizations of human-nature interactions in urban green spaces. Landscape and Urban Planning, 217, 104261.

Feng, Y., & Sester, M. (2018). Extraction of pluvial flood relevant volunteered geographic information (VGI) by deep learning from user generated texts and photos. ISPRS International Journal of Geo-Information, 7(2), 39.

Recommended course videos (in class or after class)

▶ **Natural Language Processing In 5 Minutes | What Is NLP And How Does It Work? | Simpli…**

▶ **Complete RoadMap To Learn Computer Vision**

Week 5: Introduction to Large Language Models (LLMs) and ChatGPT

- **Description:** Understanding LLMs, ChatGPT, and ethical considerations in using LLMs.
- **Activities:** Lecture on LLMs and their use cases, practical applications.
- **Lab 5:** Implementing and using LLaMA-3 to develop a chatbot.

Group member 3 start

Course Outline

Lecture and Discussion Topics:

Introduction to Large Language Models (LLMs)

- Definition and importance of LLMs
- Evolution of LLMs: From early models to modern architectures
- Key concepts: Transformers, attention mechanisms, and model scaling

Understanding ChatGPT

- Overview of ChatGPT and its capabilities
- How ChatGPT works: Training process and architecture
- Use cases and applications of ChatGPT in various fields

Ethical Considerations in Using LLMs

- Bias in language models and its implications
- Privacy concerns and data security
- Ethical guidelines and best practices for deploying LLMs

- Responsible AI: Ensuring fairness, accountability, and transparency

Practical Applications of LLMs

- Case studies and examples of LLM applications
- Discussion on the impact and challenges of using LLMs in social sciences

Recommended Reading and Assignments

Wang, S., Hu, T., Xiao, H., Li, Y., Zhang, C., Ning, H., ... & Ye, X. (2024). GPT, large language models (LLMs) and generative artificial intelligence (GAI) models in geospatial science: a systematic review. *International Journal of Digital Earth*, *17*(1), 2353122.

Lin, Z., Deng, C., Zhou, L., Zhang, T., Xu, Y., Xu, Y., ... & Zhou, C. (2023). Geogalactica: A scientific large language model in geoscience. *arXiv preprint arXiv:2401.00434*.

Hadid, A., Chakraborty, T., & Busby, D. (2024). When Geoscience Meets Generative AI and Large Language Models: Foundations, Trends, and Future Challenges. *arXiv preprint arXiv:2402.03349*.

Manvi, R., Khanna, S., Mai, G., Burke, M., Lobell, D., & Ermon, S. (2023). Geollm: Extracting geospatial knowledge from large language models. *arXiv preprint arXiv:2310.06213*.

Recommended course videos (in class or after class)

▶ How Large Language Models Work

▶ What are Large Language Models (LLMs)?

▶ Development with Large Language Models Tutorial – OpenAI, Langchain, Agents, Chroma

Week 6: Introduction to the Segment Anything Model (SAM) and segment-geospatial package

- **Description:** Understanding SAM, its applications, and ethical considerations in using visual models.
- **Activities:** Lecture on SAM and their use cases, practical examples.

- **Lab 6:** Implementing and using SAM to segment trees on images using esri SAM package.
- Using the Segment-Geospatial Python Package.

Course Outline

Lecture and Discussion Topics:

Introduction to the Segment Anything Model (SAM)

- Definition and importance of SAM
- Overview of SAM and its architecture
- Key features and capabilities of SAM

Applications of SAM

- Use cases of SAM in various fields, with a focus on social sciences and humanities
- Examples of SAM applications: environmental monitoring, urban planning, etc.

Understanding the Segment-Geospatial Package

- Overview of the Segment-Geospatial package
- Key functionalities and use cases
- Integration of SAM with geospatial data

Ethical Considerations in Using Visual Models

- Privacy concerns and data security
- Ethical guidelines and best practices for deploying visual models
- Responsible AI: Ensuring fairness, accountability, and transparency

Recommended Reading and Assignments

Kirillov, A., Mintun, E., Ravi, N., Mao, H., Rolland, C., Gustafson, L., ... & Girshick, R. (2023). Segment anything. In *Proceedings of the IEEE/CVF International Conference on Computer Vision* (pp. 4015-4026).

Osco, L. P., Wu, Q., de Lemos, E. L., Gonçalves, W. N., Ramos, A. P. M., Li, J., & Junior, J. M. (2023). The segment anything model (sam) for remote sensing applications: From zero to one shot. *International Journal of Applied Earth Observation and Geoinformation*, *124*, 103540.

Wu, Q., & Osco, L. P. (2023). samgeo: A Python package for segmenting geospatial data with the Segment Anything Model (SAM). *Journal of Open Source Software*, *8*(89), 5663.

Ren, S., Luzi, F., Lahrichi, S., Kassaw, K., Collins, L. M., Bradbury, K., & Malof, J. M. (2024). Segment anything, from space?. In *Proceedings of the IEEE/CVF Winter Conference on Applications of Computer Vision* (pp. 8355-8365).

Recommended course videos (in class or after class)

▶ **Introducing segment-geospatial for segmenting geospatial data with the Segment …**

▶ Segmenting Satellite Imagery with the Segment Anything Model (SAM)

▶ Explaining the Segment Anything Model - Network architecture, Dataset, Training

Weeks 7-8: Generative AI and Critique

Week 7: Introduction to Generative AI for Social Sciences and Humanities

- **Description:** Introduction to generative AI, its applications, and key concepts. Emphasis on theoretical knowledge and practical applications.
- **Activities:** Lectures on generative AI and applications, practical examples.
- **Lab 7:** Utilize SD models to create and comment on AI-generated images.
- Generate and analyze images depicting historical or cultural scenes, discussing how AI can empower social sciences and humanities.

Course Outline

Lecture and Discussion Topics:

Introduction to Generative AI

- Definition and importance of generative AI
- Historical background and evolution of generative models
- Overview of key generative AI concepts: GANs, VAEs, and Diffusion Models

Applications of Generative AI

- Use cases in various fields, with a focus on social sciences and humanities
- Examples of generative AI applications: art, literature, historical reconstruction, cultural heritage preservation

Key Concepts in Generative AI

- Generative Adversarial Networks (GANs)
  - Architecture and working principle
  - Examples and applications
- Variational Autoencoders (VAEs)
  - Architecture and working principle
  - Examples and applications
- Diffusion Models
  - Architecture and working principle
  - Examples and applications

Theoretical Knowledge and Practical Applications

- Understanding the theoretical foundation of generative models
- Practical applications in creating and analyzing AI-generated content
- Ethical considerations in generative AI

Recommended Reading and Assignments

Rane, N. (2023). Role and Challenges of ChatGPT and Similar Generative Artificial Intelligence in Arts and Humanities. *Available at SSRN 4603208*.

Fui-Hoon Nah, F., Zheng, R., Cai, J., Siau, K., & Chen, L. (2023). Generative AI and ChatGPT: Applications, challenges, and AI-human collaboration. *Journal of Information Technology Case and Application Research*, *25*(3), 277-304.

Rane, N., & Choudhary, S. (2024). Role and challenges of ChatGPT, Google Bard, and similar generative Artificial Intelligence in Arts and Humanities. *Studies in Humanities and Education*, *5*(1), 1-11.

Li, W. (2022). GeoAI in social science. *Handbook of Spatial Analysis in the Social Sciences*, 291-304.

Recommended course videos (in class or after class)

▶ What Is Generative AI | Generative AI Explained | Introduction to Generative AI | Intellipaat

▶ Virtual Seminar: What can AI do for the Humanities and Social Sciences? (Sep 9, 2020)

Week 8: Critique of Generative AI

- **Description:** Focuses on the critical perspectives of AI-generated art, ethical considerations, and practical critique of AI generation.
- **Activities:** Lecture on AI in arts, disadvantages, and ethical issues.
- **Lab 8:** Create and comment on AI-generated images, focusing on discovering logical problems.
- Write a critical analysis of AI-generated art, preparing for the final project.

Course Outline

Lecture and Discussion Topics:

Introduction to AI-Generated Art

- Overview of AI-generated art
- Historical context and evolution of AI in the arts
- Examples of notable AI-generated artworks

Critical Perspectives of AI-Generated Art

- Aesthetic and philosophical critiques
- Comparison between human and AI-generated art
- The role of creativity and originality in AI art

Ethical Considerations in AI-Generated Art

- Issues of authorship and ownership
- Impact on artists and the creative industry
- Bias and representation in AI-generated art

Practical Critique of AI Generation

- Identifying logical problems and inconsistencies in AI-generated content
- Analyzing the quality and coherence of AI-generated art
- Discussing the limitations and potential improvements of generative models

Recommended Reading and Assignments

Galanter, P. (2019, July). Artificial intelligence and problems in generative art theory. In *Proceedings of EVA London 2019*. BCS Learning & Development.

Messeri, L. (2023). Teaching with ChatGPT: Critiquing Generative Artificial Intelligence from the Classroom. *Anthropology Now*, *15*(1), 84-92.

Leaver, T., & Srdarov, S. (2023). ChatGPT Isn't Magic: The Hype and Hypocrisy of Generative Artificial Intelligence (AI) Rhetoric. *M/C Journal*, *26*(5).

Popenici, S. (2023). The critique of AI as a foundation for judicious use in higher education. *Journal of Applied Learning and Teaching*, *6*(2).

Recommended course videos (in class or after class)

▶ Debunking the great AI lie | Noam Chomsky, Gary Marcus, Jeremy Kahn

▶ Generative AI in a Nutshell - how to survive and thrive in the age of AI

▶ A.I. is B.S.

Weeks 9-10: Final Project Design and Presentation

Week 9: Emerging Topics in AI and Society

- **Description:** Covers emerging topics in AI and society, AI as a social entity, and its impact on new spatial experiences and space planning.

- **Activities:** Lecture on emerging topics, project studio.

- Project work session, design the final project.

Course Outline

Lecture and Discussion Topics:

Emerging Topics in AI

- Overview of cutting-edge AI research and technologies
- AI in various sectors: healthcare, education, transportation, etc.
- Future trends and potential breakthroughs in AI

AI as a Social Entity

- The concept of AI as a participant in society
- Social implications of AI presence and interaction
- Ethical considerations and societal impact

AI's Impact on New Spatial Experiences

- How AI is transforming urban spaces and planning
- Smart cities and AI-driven infrastructure
- Case studies of AI in spatial planning and urban design

AI and Space Planning

- AI tools and techniques in space planning
- Collaborative AI-human design processes
- Real-world applications and examples

Recommended Reading and Assignments

Ulnicane, I., Knight, W., Leach, T., Stahl, B. C., & Wanjiku, W. G. (2021). Framing governance for a contested emerging technology: insights from AI policy. *Policy and Society*, *40*(2), 158-177.

Luusua, A., Ylipulli, J., Foth, M., & Aurigi, A. (2023). Urban AI: understanding the emerging role of artificial intelligence in smart cities. *AI & society*, *38*(3), 1039-1044.

Stahl, B. C. (2021). *Artificial intelligence for a better future: an ecosystem perspective on the ethics of AI and emerging digital technologies* (p. 124). Springer Nature.

Borenstein, J., & Howard, A. (2021). Emerging challenges in AI and the need for AI ethics education. *AI and Ethics*, *1*, 61-65.

Recommended course videos (in class or after class)

▶ Ethics of AI: Challenges and Governance

▶ AI Is Dangerous, but Not for the Reasons You Think | Sasha Luccioni | TED

▶ The Role of Artificial Intelligence in Society | Victor Fuentes | TEDxYouth@ASFM

Week 10: Project Studio and Final Project Presentation

- **Description:** Summarizes course content, focuses on final project completion and presentation.

- **Activities:** Project studio, final project presentations.

- Final project work session, prepare for presentations.

This outline integrates technical, practical, and ethical components of AI, tailored for social sciences and humanities students, with a strong emphasis on practical labs and projects to apply learned concepts.

Recommended course videos (in class or after class)

▶ End To End LLM Conversational Q&A Chatbot With Deployment
▶ Build a Large Language Model AI Chatbot using Retrieval Augmented Generation
▶ Build your own LLM chatbot from scratch | End to End Gen AI | End to End LLM | Mistrak …

每周要有一些阅读材料
不用esri，因为课程面向大众
如果叫GeoAI，怎么界定Geo？第一节课讲ai和Geo相关的概念。

框架：2-3个youtube（具体事例（无人驾驶 ）），强围绕主题，网上blog），2-3篇论文（2022以后，特别好的）(写小论文），每周的大标题下面给出小标题(week4-8)(PPT)，实验具体的名称and proposal(lab)，data source，期末项目（geochat, group format(checkpoint)）course load

Course Syllabus: AI for Social Sciences and Humanities

Instructors: Yifan Yang & Haowen Wei

Format:

4. **Google Colab:** Convenient for code reproduction, code sharing, simple environment configuration, and URL sharing.
5. **Github:** Students may be required to apply for a GitHub account, which allows them to perform operations such as fork, code management, and learning.
6. **Hugging Face:** Use models available on Hugging Face. Students will learn how to download, configure, and use these models on GitHub and conduct experiments in Colab.

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▶ What is Web Crawler and How Does It Work?

▶ Web Scraping vs Web Crawling Explained

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- **Description:** Focuses on supervised vs. unsupervised learning, key algorithms, deep learning basics, and evaluation metrics. Emphasis on practical applications in specific fields.

▶ Machine Learning vs Deep Learning

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[Machine Learning Specialization by Andrew Ng - YouTube](#)

- **Activities:** Lecture on ML and DL concepts, practical examples.

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Weeks 4-6: Visual and Language Models

Week 4: Introduction to Basic Natural Language Processing and Computer Vision in Social Science

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June 3, 2024

Course Syllabus: AI for Social Sciences and Humanities

Instructors: Yifan Yang & Haowen Wei

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- **Description:** Focuses on supervised vs. unsupervised learning, key algorithms, deep learning basics, and evaluation metrics. Emphasis on practical applications in specific fields.
- **Activities:** Lecture on ML and DL concepts, practical examples.
- **Lab 3:** Implement and evaluate a simple ML model using open-source tools. Predicting housing prices and population migration patterns with Python libraries like Scikit-learn.

Weeks 4-6: Visual and Language Models

Week 4: Introduction to Basic Natural Language Processing and Computer Vision in Social Science

- **Description:** Introduces the basics of NLP and CV, key algorithms, and their applications in social sciences.
- **Activities:** Lecture on NLP and CV basics, comprehensive lecture covering techniques and concepts.
- **Lab 4:** Sentiment analysis using NLTK and TextBlob, image processing and classification using OpenCV or PyTorch.

Week 5: Introduction to Large Language Models (LLMs) and ChatGPT

- **Description:** Understanding LLMs, ChatGPT, and ethical considerations in using LLMs.
- **Activities:** Lecture on LLMs and their use cases, practical applications.
- **Lab 5:** Implementing and using LLaMA-3 to develop a chatbot.

Week 6: Introduction to the Segment Anything Model (SAM) and segment-geospatial package

- **Description:** Understanding SAM, its applications, and ethical considerations in using visual models.
- **Activities:** Lecture on SAM and their use cases, practical examples.
- **Lab 6:** Implementing and using SAM to segment trees on images using esri SAM package.
- Using the Segment-Geospatial Python Package.

Weeks 7-8: Generative AI and Critique

Week 7: Introduction to Generative AI for Social Sciences and Humanities

- **Description:** Introduction to generative AI, its applications, and key concepts. Emphasis on theoretical knowledge and practical applications.
- **Activities:** Lectures on generative AI and applications, practical examples.
- **Lab 7:** Utilize SD models to create and comment on AI-generated images.
- Generate and analyze images depicting historical or cultural scenes, discussing how AI can empower social sciences and humanities.

Week 8: Critique of Generative AI

- **Description:** Focuses on the critical perspectives of AI-generated art, ethical considerations, and practical critique of AI generation.
- **Activities:** Lecture on AI in arts, disadvantages, and ethical issues.
- **Lab 8:** Create and comment on AI-generated images, focusing on discovering logical problems.
- Write a critical analysis of AI-generated art, preparing for the final project.

Weeks 9-10: Final Project Design and Presentation

Week 9: Emerging Topics in AI and Society

- **Description:** Covers emerging topics in AI and society, AI as a social entity, and its impact on new spatial experiences and space planning.
- **Activities:** Lecture on emerging topics, project studio.
- Project work session, design the final project.
-

Week 10: Project Studio and Final Project Presentation

- **Description:** Summarizes course content, focuses on final project completion and presentation.
- **Activities:** Project studio, final project presentations.
- Final project work session, prepare for presentations.

This outline integrates technical, practical, and ethical components of AI, tailored for social sciences and humanities students, with a strong emphasis on practical labs and projects to apply learned concepts.

May 29,2024

GEOG 404 Course Outline: AI for Social Sciences and Humanities

Yifan Yang & Haowen Wei

Format:

1.　　Google Colab (Convenient for code reproduction, code sharing, simple environment configuration, and URL sharing.)

2.　　Github (Students may be required to apply for a github account, which allows them to perform operations such as fork, code management and learning.)

3.　　Hugging Face(We can use the model on huggingface. Students know where to download it, and then learn how to configure and use it on github, and conduct experiments in colab.)

4.　　Geog 458

The general content, that is, the 10 weeks can be understood this way.我们假设每周两次课程和一次实验课的工作量

Week1-week3 is a session, which is an introduction to basic content such as courses, AI, and data.

Week4-6 is session we introduce visual models and language models.

Week7-8 is session about generative AI and criticizing generative AI.

Week9-10 is session we introduce AI for good and complete the final project.

Week 1: Introduction to AI in Social Sciences and Humanities

●Topics:

　●Overview of AI: Definitions and Historical Context

　●Relevance of AI in Social Sciences and Humanities

　●Key Concepts: Machine Learning, Neural Networks, and Natural Language Processing (NLP), computer vision(CV), Large language model(LLMs), generative AI(AGI).这部分我们会把后面要介绍的概念串起来

Why does AI matter in Social Sciences and Humanities?

Diminishing their fear is vital for social science students. We need to explain it in a simple way.

●Activities:

　●Lecture and Discussion

　●Case Studies of AI applications in Social Sciences and Humanities

　　●　Provide some interesting YouTube videos to explain the development of AI and its application in Social science and Humanities.

　●Lab 1: Introduction to Colab and Basic Python for AI.

Colab has inner guidance. In case somebody hasn't touched python before, we will design a basic python tutorial on colab including reading files, printing results, introducing basic data structure and how to install packages. If it is too simple for some students, we will recommend some tutorials in LinkedIn.

　●Application: Analyzing historical text data for spatial-temporal patterns

　●Assignment: Readings and Reflection Paper on AI's impact on society

Week 2: Introduction to Data Science and AI for Social Science

●Topics:

●what is data science and what is data(ai)4science(domain knowledge)
  ●Data Types and Sources
  ● Structured vs. Unstructured Data
  ● Data Sources: Surveys, Social Media, Archives
 ● geospatial data (vector data vs pixel data) and The connection between geographical laws and data
  ●For the application of AI for science, esri has an example of SAM visual model for remote sensing image segmentation.
●Activities:
  ●Lecture on Data Collection Techniques (data life cycle), provide some data websites and tutorials on web crawlers.
  ●Lab 2: Cleaning and Preparing a Social Media Dataset using Pandas
We can use the given bigfoot data set, then perform data preprocessing, and use the API to infer the latitude and longitude of the geographical location in the text data. The bigfoot data set contains many cases that others have seen and suspected of being bigfoot, including the reporting time, location, time, comments, etc.●Application: Mapping social media activity to geographical locations over time
  ●Assignment: Data Collection Project Proposal
It can quickly carry out data collection (we can provide bigfoot's data set, which can also be downloaded from the official website), data preprocessing (removing duplication, completing data, etc.), and data analysis (using API to complete text inference of longitude and latitude coordinates and turn them into point data) and data visualization (based on point data, you can visualize arcgis pro or use other visualization python methods).

Week 3: Introduction to Machine Learning and Deep learning Application
这里面重要的一点是我们期望更多的体现ml和dl在具体领域的应用，算法和模型可以是第一次的内容，应用是第二次课的内容。或者ml一节课，dl一节课
●Topics: (ML in the first class, DL in the second class)
  ●Supervised vs. Unsupervised Learning
  ●Key Algorithms: Linear Regression, Decision Trees, K-means Clustering
  ●Deep Learning and Neural Networks
  ●example: Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs) .DL can only give examples. As it is complicated and we can greatly reduce the content of this part of the explanation.
  ●Evaluation Metrics: Accuracy, Precision, Recall

●Activities:
  ●Lecture on Machine Learning and Deep learning Concepts
  ●Assignment: Implement and Evaluate a Simple Machine Learning Model
  ●Application: Predicting housing prices based on spatial data, Predicting population migration patterns based on socio-economic data
Lab3:
If experiments are involved this week, we can directly use ArcGIS pro to predict house prices using GWR, decision tree and other methods. This link does not require coding, and the software can be used to directly conduct experiments and assignments.

Week 4: Introduction to basic Natural Language Processing and Computer Vision in Social Science

三四周是不需要合并的，因为nlp和cv本身值得讨论的地方就非常多，我们同样是关注应用。这里的cv和nlp也是为后面几周的语言大模型和视觉大模型做基础。第一次课讲nlp，一次课讲cv

●Topics:
  ●Introduction to NLP AND CV
  ●Why we must understand NLP and CV

WHW: As a student majoring in human geography, I think we need to present some attractive examples with fancy visualization (like implementing sentiment analysis to social media comments) to attract students with a social science background.

  ●-NLP Basics:
      - Word segmentation, stemming, lemmatization
      - Sentiment analysis and text classification
  - CV Basics:
      - Basic concepts: image processing, feature detection
      - Introduction to key algorithms: Convolutional Neural Network (CNN), image classification
  - Applications in social sciences, humanities and other fields:
      - NLP: Analyze text data to understand public sentiment, social media trends
      - CV: Image analysis in urban planning, secure facial recognition, remote sensing image, landuse

●Activities:
  ●NLP and CV Basics Lecture
  ●Comprehensive lecture covering basic techniques and concepts in NLP and CV, illustrating their application and importance in real-life scenarios.
  ●NLP Lab: Sentiment analysis of social media text using libraries like NLTK and TextBlob.
  ●CV Lab: Basic image processing and classification using Python and libraries like OpenCV or PyTorch.
  ●Application:Use text analytics to analyze public sentiment on urban development projects. Use image data to assess changes in urban landscapes or public spaces.
  ●NLP and CV Project Proposal: Students propose a project that combines NLP and CV techniques to solve a problem or analyze data in the social sciences, humanities, or any other area of interest.

Week 5: Introduction to Large Language Models (LLMs) and ChatGPT
●Topics:
  ●Introduction to Large Language Models and foundation models?
  ●Understanding ChatGPT and Its Applications
  ●Ethical Considerations in Using LLMs
●Activities:
  ●Lecture on LLMs and Their Use Cases
  ●Lab 8: Implementing and Using LLaMA-3 to Develop a Chatbot (**final project**)
  ●Application: Creating a chatbot that provides historical or cultural information
  ●Assignment: Develop a Small Application using ChatGPT for Social Science Research
  ●Optional Lab: Implementing and Using ChatGPT via OpenAI API

Worries: I'm wondering what's UW's attitude towards using ChatGPT on courses? Would you suggest students use it to improve efficiency? Or would you ban it because it makes study easier? For me I think ChatGPT or other GenAI significantly reduces the impediments to the application of ai for students from social science backgrounds. (请问赵老师什么想法 zhaobo@uw.edu)

我们的期末项目是设计一个social sicence相关主题的ai助教机器人，可以回答相关的问题。例如地理助教机器人，涉及数据收集（文本，视频，音频，图片来回答），数据清洗，语言模型结合和领域知识部分的工作。可以作具体的机器人助教，比如肥胖健康机器人，艺术人文机器人来回答这些领域或者子领域的问题。目的是提高大众对于这些知识的了解程度和节省时间。

Week 6: Introduction to the Segment Anything Model (SAM) and segment-geospatial package
●Topics:
   ●Introduction to SAM
   ●Understanding SAM and Its Applications
   ●Ethical Considerations in Using visual model and why visual model is not good as LLMs
●Activities:
   ●Lecture on SAM and Their Use Cases
   ●Lab 9: Implementing and Using SAM to segment tree on images
   ●Application: using esri SAM package and segmenting something(trees, swimming pool). We have videos and samples.
   ●Assignment: Using the Segment-Geospatial Python Package with ArcGIS Pro
Reference https://samgeo.gishub.org/

Week 7 and 8 are closely related.
Week 7 allows students to have a general understanding of what generative AI is and what specific role it can play, and then play a good role in Social Sciences and Humanities.
Week 8 is for students to try to criticize and reflect on GenAI

Week 7: Generative AI Arts and CritiqueIntroduction to Generative AI and GenAI for Social Sciences and Humanities
For w7 & w8, we can cover this topic in two weeks, emphasizing on basic theoretical knowledge in the first week and doing a chat box in the second week. Some critique related content can be added in the second week, but it is better to put it in two weeks overall.

Topics:
   ●Introduction to Generative AI
   Overview of what generative AI is and its various applications.
   ●Key Concepts in Generative AI
   ●diffusion model
   ● GenAI for Social Sciences and Humanities
●Activities:
   ●Lectures on generative AI and applications
   ●Lab: Utilize SD models to create and comment on AI-generated images
   ●Application: Generate and analyze images depicting historical or cultural scenes

●Assignment: If it is the AGI era and AI can generate any content, then how can AI empower Social Sciences and Humanities.

It can be possible to open a seminar or lunch meeting about this assignment. Just communicate whatever is related. Or we can give students a chance to provide some ideas to future course design about AI x Social Sciences and Humanities.

Week 8: Generative AI Arts and Critique
Topics:
   ●Introduction to AI-generated Art
   ●Disadvantages of AI generation, content errors, privacy violations, ethics.
   ●Tools for AI Art Creation: MidJourney, DALL-E, etc.
   ●Critical Perspectives on AI Art
●Activities:
   ●Lecture on AI in Arts
   ●Lab: Create and comment on images generated by artificial intelligence, focusing on discovering logical problems, etc.
   ●Application: Generating and analyzing images that depict historical or cultural scenes
   ●Assignment: Write a Critical Analysis of AI-generated Art

Week 8 Design llam3 design a chatbot, prepare for the final project.(chatbox)
Design an AI teaching assistant robot with the help of any tools such as GPT-4, LLam3, etc

第七周和第八周两周来讨论genai是有必要的，这部分内容可以无限延申，以及生成式本身也是提高想象力和打开和批判ai的重要章节。第七周主要是基础理论，第八周是思考和批判，以及解决期末项目中的一些重要问题

Week9 and week10 can be used to design the final project, but when we talk about LLMs in week5, we will start the final chatbot final project design.
.
Week 9: emerging topics in AI and society

Lecture 1: emerging topics in AI and society

Lecture 2: project studio

我注意到前面的part大部分在讲AI在社科方面的应用和AI的ethics问题，在最后，也许还可以引入AI作为社会实体的思考，以及如何理解AI的行为特征的部分；或者加上更具体和space层面有关的讨论，比如AI如何影响新的空间体验、新的空间规划模式、如何影响实体空间和资源结构的重新配置；以及AI有关的物质主体如服务器、计算机的冷却系统的社会影响讨论。

也可以来讨论**ai agent**，斯坦福小镇，平均人，用**ai agent**来模拟人的行为也是很有意思的主题

Week 10: project studio and final project presentation

课程总结，因为我们课程设计了非常多的ai的话题和方面，可以来发掘学生最感兴趣的部分是什么，同样，可以在提供最新的ai的视频
Lecture 1: project studio
Lecture 2: final project presentation

May 25,2024

GEOG 404 Course Outline: AI for Social Sciences and Humanities

Yifan Yang
Format:
1.   Google Colab (Convenient for code reproduction, code sharing, simple environment configuration, and URL sharing.)
2.   Github (Students may be required to apply for a github account, which allows them to perform operations such as fork, code management and learning.)
3.   Hugging Face(We can use the model on huggingface. Students know where to download it, and then learn how to configure and use it on github, and conduct experiments in colab.)
4.   Geog 458

The general content, that is, the 10 weeks can be understood this way.
Week1-week3 is a session, which is an introduction to basic content such as courses, AI, and data.
Week4-6 is session we introduce visual models and language models.
Week7-8 is session about generative AI and criticizing generative AI.
Week9-10 is session we introduce AI for good and complete the final project.

Week 1: Introduction to AI in Social Sciences and Humanities
●Topics:
   ●Overview of AI: Definitions and Historical Context
   ●Relevance of AI in Social Sciences and Humanities
   ●Key Concepts: Machine Learning, Neural Networks, and Natural Language Processing (NLP), computer vision(CV), Large language model(LLMs), generative AI(AGI) (WHW: Diminishing their fear is vital for social science undergraduates)
●Activities:
   ●Lecture and Discussion
   ●Case Studies of AI applications in Social Sciences and Humanities

●Lab 1: Introduction to Colab (Jupyter Notebooks) and Basic Python for AI (If UW has LinkedIn Learning, students can complete python learning on LinkedIn.)（colab内置教程）
●Application: Analyzing historical text data for spatial-temporal patterns
●Assignment: Readings and Reflection Paper on AI's impact on society
In fact, I think it is more interesting for students to watch YouTube videos explaining the development of AI. (WHW: or maybe Andrew Ng's machine learning videos in week3 part)
WenJing: In addition to Andrew Ng's machine learning videos, recommend some short and vivid AI science videos, such as TED talks or science documentaries, to help students better understand the history and current status of AI.

Comments from Tongwei: 在key concepts部分之前，可能可以重点梳理一些基本概念和结构，这样对于社科背景的同学来说，也许更容易有线索，会不那么困惑。我按照后文的架构粗略地想了一下，AI的相关内容可以按照数据——算法（简要讲述）——处理目标三部分来整合：
（1）Data，也就是对应第二节，从语言到视觉图像、音频到三维和多模态数据，此处可以提及有影响力的数据库如ImageNet，也由此引申出更后面的三个对应领域Computer Vision, Natural Language Processing (Large language Model such as GPT-3, LLaMA) and Multimodal Models (如果有这一部分的话，如GPT-4V, CLIP,…)
（2）Algorithmic Architectures（从ML-DL到CNN, RNN, GANs, Transformers…）
（3）Task Objectives（recognition, deduction, generation, interaction…由此对应最后几部分一些具体的application，比如image-segment tools, chatbot, generative art… ）
WHW：课程可能无法深入讲解算法的原理，更多是应用ai，完全把ai作为应用社会科学的工具。

Week 2: Introduction to Data Science and AI for Social Science

●Topics:
 ●what is data science and what is data(ai)4science(domain knowledge)
  ●Data Types and Sources
  ● Structured vs. Unstructured Data
  ● Data Sources: Surveys, Social Media, Archives
 ● geospatial data (vector data vs pixel data) and The connection between geographical laws and data
  ●For the application of AI for science, esri has an example of SAM visual model for remote sensing image segmentation.
●Activities:
  ●Lecture on Data Collection Techniques(data life cycle)
  WHW: maybe we can provide some accessible data websites and teach them how to practice web crawler? Because for many social science and humanity students, this is the first barrier for them to practice data analysis, especially AI application.
  ●Lab 2: Cleaning and Preparing a Social Media Dataset using Pandas
  we can use the given bigfoot data set, then perform data preprocessing, and use the API to infer the latitude and longitude of the geographical location in the text data. The bigfoot data set contains many cases that others have seen and suspected of being bigfoot, including the reporting time, location, time, comments, etc.（这个数据集非常适合练习数据清洗和地理数据处理，并且可以使用文本推断地理位置）

- ●Application: Mapping social media activity to geographical locations over time
- ●Assignment: Data Collection Project Proposal

It can quickly carry out data collection (we can provide bigfoot's data set, which can also be downloaded from the official website), data preprocessing (removing duplication, completing data, etc.), and data analysis (using API to complete text inference of longitude and latitude coordinates and turn them into point data) and data visualization (based on point data, you can visualize arcgis pro or use other visualization python methods).

Week 3: Introduction to Machine Learning and Deep learning Application

- ●Topics:
  - ●Supervised vs. Unsupervised Learning
  - ●Key Algorithms: Linear Regression, Decision Trees, K-means Clustering
  - ●Deep Learning and Neural Networks (WHW: How should we teach it? By which means)
  - ●example: Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs) I think DL can only give examples. DL is too complicated and we can greatly reduce the content of this part of the explanation.
  - ●Evaluation Metrics: Accuracy, Precision, Recall

- ●Activities:
  - ●Lecture on Machine Learning and Deep learning Concepts
  - ●Assignment: Implement and Evaluate a Simple Machine Learning Model
  - ●Application: Predicting housing prices based on spatial data, Predicting population migration patterns based on socio-economic data

Lab3:

If experiments are involved this week, we can directly use ArcGIS pro to predict house prices using GWR, decision tree and other methods. This link does not require coding, and the software can be used to directly conduct experiments and assignments. If we can't use ArcGIS pro, we will provide a coding sample for students to use in Colab.

Week 4: Introduction to basic Natural Language Processing and Computer Vision in Social Science

- ●Topics:
  - ●Introduction to NLP AND CV
  - ●Why we must understand NLP and CV

  - ●-NLP Basics:
    - - Word segmentation, stemming, lemmatization
    - - Sentiment analysis and text classification
  - - CV Basics:
    - - Basic concepts: image processing, feature detection
    - - Introduction to key algorithms: Convolutional Neural Network (CNN), image classification
  - - Applications in social sciences, humanities and other fields:
    - - NLP: Analyze text data to understand public sentiment, social media trends(visualization)
    - - CV: Image analysis in urban planning, secure facial recognition, remote sensing image, land use

●Activities:
  ●NLP and CV Basics Lecture
  ●Comprehensive lecture covering basic techniques and concepts in NLP and CV, illustrating their application and importance in real-life scenarios.
  ●NLP Lab: Sentiment analysis of social media text using libraries like NLTK and TextBlob.
  ●CV Lab: Basic image processing and classification using Python and libraries like OpenCV or PyTorch.
    ●Application:Use text analytics to analyze public sentiment on urban development projects. Use image data to assess changes in urban landscapes or public spaces.
    ●NLP and CV Project Proposal: Students propose a project that combines NLP and CV techniques to solve a problem or analyze data in the social sciences, humanities, or any other area of interest.

We'll only introduce a simple CV based on pixels and objects, which are what the lab contains. Only basic application for neural networks.

Week 5: Introduction to Large Language Models (LLMs) and ChatGPT
●Topics:
  ●Introduction to Large Language Models and foundation models?
  ●Understanding ChatGPT and Its Applications
  ●Ethical Considerations in Using LLMs
●Activities:
  ●Lecture on LLMs and Their Use Cases
  ●Lab 8: Implementing and Using LLaMA-3 to Develop a Chatbot(**final project**)
  ●Application: Creating a chatbot that provides historical or cultural information
  ●Assignment: Develop a Small Application using ChatGPT for Social Science Research
  ●Optional Lab: Implementing and Using ChatGPT via OpenAI API
WHW: I'm wondering what's UW's attitude towards using ChatGPT on courses? Would you suggest students use it to improve efficiency? Or would you ban it because it makes study easier? For me I think ChatGPT or other GenAI significantly reduces the impediments to the application of ai for students from social science backgrounds（整体比较敏感，可能要看赵老师的想法）

Week 6: Introduction to the Segment Anything Model (SAM) and segment-geospatial package
●Topics:
  ●Introduction to SAM
  ●Understanding SAM and Its Applications
  ●Ethical Considerations in Using visual model and why visual model is not good as LLMs
●Activities:
  ●Lecture on SAM and Their Use Cases
  ●Lab 9: Implementing and Using SAM to segment tree on images
  ●Application: using esri SAM package and segment something(trees, swimming pool)
  ●Assignment: Using the Segment-Geospatial Python Package with ArcGIS Pro

Reference
WHW: Are there massive differences between this segmentation lecture and CV lecture? Do we need to leave a week for this lecture?

Week 7 and 8 are closely related.
Week 7 allows students to have a general understanding of what generative AI is and what specific role it can play, and then play a good role in Social Sciences and Humanities.
Week 8 is for students to try to criticize and reflect on GenAI

Week 7: Introduction to Generative AI and GenAI for Social Sciences and Humanities
Topics:
- ●Introduction to Generative AI
  Overview of what generative AI is and its various applications.
- ●Key Concepts in Generative AI
- ●diffusion model
- ● GenAI for Social Sciences and Humanities
●Activities:
- ●Lectures on generative AI and applications
- ●Lab: Utilize SD models to create and comment on AI-generated images
- ●Application: Generate and analyze images depicting historical or cultural scenes
- ●Assignment: If it is the AGI era and AI can generate any content, then how can AI empower Social Sciences and Humanities.
  WHW: Is it possible to open a seminar or lunch meeting about this assignment? Just communicate whatever is related. Or we can give students a chance to provide some ideas to future course design about AI x Social Sciences and Humanities.

Week 8: Generative AI Arts and Critique
Topics:
- ●Introduction to AI-generated Art
- ●Disadvantages of AI generation, content errors, privacy violations, ethics.
- ●Tools for AI Art Creation: MidJourney, DALL-E, etc.
- ●Critical Perspectives on AI Art
●Activities:
- ●Lecture on AI in Arts
- ●Lab: Create and comment on images generated by artificial intelligence, focusing on discovering logical problems, etc.
- ●Application: Generating and analyzing images that depict historical or cultural scenes
- ●Assignment: Write a Critical Analysis of AI-generated Art

Week 9: AI for Social Good
●Topics:
●AI Applications in Public Health, Education, and Social Justice

●Case Studies of Successful AI Projects for Social Good

●Challenges and Opportunities in AI for Social Good

●Activities:

●Guest Lecture: AI for Social Good

●Lab 9: Designing an AI Model for a Social Good Application

●Application: Developing a model to identify and address food deserts in urban areas

●Assignment: Group Project Proposal on AI for Social Good

Week 10: Reflective Practices in AI and Final Projects
●Topics:
  ●Critical Thinking and AI
  ●Reflecting on AI's Role in Society
  ●Integrating AI with Humanities Perspectives
●Activities:
  ●Student Presentations of Final Projects
  ●Peer Review Session
  ●Lab 10: Final Touches on Projects and Preparing Presentation Materials
  ●Application: Presenting and critiquing spatial-temporal AI applications
  You can design an AI teaching assistant robot with the help of any tools such as GPT-4, LLam3, etc.
  ●Course Evaluation and Feedback

  Week9 and week10 can be used to design the final project, but when we talk about LLMs in week5, we will start the final chatbot final project design.

Additional Components
●Final Project: Utilize what you have learned to create a comprehensive AI project.
●Office Hours: Weekly office hours for one-on-one student support
●Reading List: Curated list of essential readings and resources
●Online Forum: Platform for discussions, questions, and collaboration
Optional Lab on Language Translation using OpenAI Whisper
●Topics:
●Introduction to Whisper and its capabilities
●Applications in language translation and transcription
●Ethical considerations in automated language translation
●Activities:
●Lab: Implementing and Using OpenAI Whisper for Language Translation
●Application: Translating historical documents or social media posts to analyze cultural and temporal changes in language use
●Assignment: Develop a Small Translation Project using Whisper
This course plan includes six core labs that integrate technical skills with applications relevant to the humanities and social sciences, particularly focusing on space-time geography. An optional lab on language translation using OpenAI Whisper is also provided, allowing students to explore and critique

AI-generated translations. This approach ensures that students not only gain technical proficiency but also understand and reflect on the implications of AI in their fields of study.

May 22, 2024

GEOG 404 Course Outline: AI for Social Sciences and Humanities

Format:
1. **Google Colab** (if not work, jupyter)
2. Github,
3. Hugging Face
4. Geog 458

Week 1: Introduction to AI in Social Sciences and Humanities

- Topics:
    - Overview of AI: Definitions and Historical Context
    - Relevance of AI in Social Sciences and Humanities
    - Key Concepts: Machine Learning, Neural Networks, and Natural Language Processing (NLP)
- Activities:
    - Lecture and Discussion
    - Case Studies of AI applications in Social Sciences and Humanities
    - Lab 1: Introduction to Jupyter Notebooks and Basic Python for AI
        - Application: Analyzing historical text data for spatial-temporal patterns
    - Assignment: Readings and Reflection Paper on AI's impact on society

Week 2: Data Collection and Preparation

- *Topics:*
    - *Types of Data: Structured vs. Unstructured*
    - *Data Sources: Surveys, Social Media, Archives*
    - *Data Cleaning and Preprocessing*

Week 3: Introduction to Machine Learning

- Topics:
    - Supervised vs. Unsupervised Learning
    - Key Algorithms: Linear Regression, Decision Trees, K-means Clustering
    - Evaluation Metrics: Accuracy, Precision, Recall
- Activities:
    - Lecture on Machine Learning Concepts
    - Lab 3: Implementing Linear Regression and Decision Trees using scikit-learn
        - Application: Predicting population migration patterns based on socio-economic data
    - Assignment: Implement and Evaluate a Simple Machine Learning Model

Week 4: Natural Language Processing (NLP)

- Topics:
    - Basics of NLP: Tokenization, Stemming, Lemmatization
    - Sentiment Analysis and Text Classification
    - Applications in Social Sciences and Humanities
- Activities:
    - Lecture on NLP Fundamentals
    - Lab 4: Sentiment Analysis on Social Media Texts using NLTK and TextBlob
        - Application: Analyzing public sentiment on urban development projects
    - Assignment: NLP Project Proposal

Week 5: Ethical Considerations in AI

Week 6: Advanced Machine Learning Techniques

- Topics:
  - Deep Learning and Neural Networks
  - Introduction to Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs)
  - Transfer Learning
- Activities:
  - Lecture on Advanced ML Techniques
  - Lab 6: Building a Simple Neural Network with Keras
    - Application: Predicting housing prices based on spatial data
  - Assignment: Deep Learning Project Proposal

Week 7: AI Arts and Critique

- Topics:
  - Introduction to AI-generated Art
  - Stable Diffusion Model
  - Tools for AI Art Creation: MidJourney, DALL-E, etc.
  - Critical Perspectives on AI Art
- Activities:
  - Lecture on AI in Arts
  - Lab 7: Creating and Critiquing AI-generated Images
    - Application: Generating and analyzing images that depict historical or cultural scenes
  - Assignment: Write a Critical Analysis of AI-generated Art

Week 8: Large Language Models (LLMs) and ChatGPT

- Topics:
    - Introduction to Large Language Models
    - Understanding ChatGPT and Its Applications
    - Ethical Considerations in Using LLMs
- Activities:
    - Lecture on LLMs and Their Use Cases
    - Lab 8: Implementing and Using LLaMA-3 to Develop a Chatbot
        - Application: Creating a chatbot that provides historical or cultural information
    - Assignment: Develop a Small Application using ChatGPT for Social Science Research
    - Optional Lab: Implementing and Using ChatGPT via OpenAI API

Week 9: AI for Social Good

- Topics:
    - AI Applications in Public Health, Education, and Social Justice
    - Case Studies of Successful AI Projects for Social Good
    - Challenges and Opportunities in AI for Social Good
- Activities:
    - Guest Lecture: AI for Social Good
    - Lab 9: Designing an AI Model for a Social Good Application
        - Application: Developing a model to identify and address food deserts in urban areas
    - Assignment: Group Project Proposal on AI for Social Good

Week 10: Reflective Practices in AI and Final Projects

- Topics:
    - Critical Thinking and AI
    - Reflecting on AI's Role in Society
    - Integrating AI with Humanities Perspectives
- Activities:
    - Student Presentations of Final Projects
    - Peer Review Session

- Lab 10: Final Touches on Projects and Preparing Presentation Materials
  - Application: Presenting and critiquing spatial-temporal AI applications
- Course Evaluation and Feedback

Additional Components

- Final Project: Utilize what you have learned to create a comprehensive AI project.
- Office Hours: Weekly office hours for one-on-one student support
- Reading List: Curated list of essential readings and resources
- Online Forum: Platform for discussions, questions, and collaboration

Optional Lab on Language Translation using OpenAI Whisper

- Topics:
  - Introduction to Whisper and its capabilities
  - Applications in language translation and transcription
  - Ethical considerations in automated language translation
- Activities:
  - Lab: Implementing and Using OpenAI Whisper for Language Translation
    - Application: Translating historical documents or social media posts to analyze cultural and temporal changes in language use
  - Assignment: Develop a Small Translation Project using Whisper

This course plan includes six core labs that integrate technical skills with applications relevant to the humanities and social sciences, particularly focusing on space-time geography. An optional lab on language translation using OpenAI Whisper is also provided, allowing students to explore and critique AI-generated translations. This approach ensures that students not only gain technical proficiency but also understand and reflect on the implications of AI in their fields of study.