Course Outline

Basic Information

Course Title	*Advanced Application of Python, Tutorials on Competition, LangChain and LLM-1, LangChain and LLM-2*
Class Schedule	Aug 17 Sat: 9:00 AM – 12:00 PM & Aug 18 Sun: 2:00 PM – 5:00 PM & Aug 19 Mon: 9:00 AM – 12:00 PM, 2:00 PM – 5:00 PM
Course Teacher	Dr. Aaron Huang
Course Materials	https://github.com/AaronHJJ

1.0 Course Description

This course provides comprehensive training in advanced data modeling techniques, including statistical and deep learning methods for time-series analysis, optimization in supply chain analytics, and image data processing. It also explores the evolution and applications of generative AI capabilities, along with practical skills in implementing LangChain. Ideal for those looking to deepen their understanding and technical proficiency in these cutting-edge areas.

1.1 Course Objective

The objectives of the courses are as follows:

- To develop skills in time-series data modeling using statistical and deep learning methods, supply chain analytics through optimization, and image data processing with deep learning.
- To explore the concepts and history of generative AI capabilities.
- To facilitate the acquisition of LangChain implementation skills.

1.2 Course Requirements

- No coding experience is needed.
- Coding sessions are done on Google Colab in Python. Google account is needed.

1.3 Competition

The competition aims to tackle real-world industry challenges. Students will be divided into groups and provided with detailed problem statements and real-world datasets to address the issues faced by industry stakeholders.

- Students will be divided into 7 groups of 4 members each.
- Submission requirements: Solutions adhering to the specified format, code and slides (maximum 5 pages). Send to oraahj@nus.edu.sg with the subject line ”Group 1” (or your respective group number). Please include the names of all group members in the email.
- Submission deadline: **8:00 PM, August 18, 2024**.

1.4 Course Delivery Plan

Lecture	Topic	Hands-On
Advanced Applications of Python	Forecasting	Time Series Analysis and Forecasting Implementation of LSTM on Air-Passenger dataset
	Supply Chain Analytics	Newsvendor Problem at Yaz
	Image Processing	Building Footprint Delineation for Disaster Risk Reduction and Response
LangChain and LLM-1	Text Generation Image Generation Image Analysis	
LangChain and LLM-2	LangChain Implementations	Models & Prompts & Parsers Chain Memory Q&A over Documents Evaluation of an LLM-based application LangChain's Agents: A Reasoning Engine

1.5 Text and Reference Materials

1. Textbook:

   - Knaflic, C. N. (2015). Storytelling with data: A data visualization guide for business professionals. John Wiley & Sons.
   - Peng, R. D., and Matsui, E. (2015). The art of data science. Leanpub, Victoria.

2. References:

   - Liu, P., Chen, Y., & Teo, C. P. (2021). Limousine service management: Capacity planning with predictive analytics and optimization. INFORMS Journal on Applied Analytics, 51(4), 280-296.
   - Scarf, H. (1958). A min-max solution of an inventory problem. Studies in the mathematical theory of inventory and production.
   - Vaswani, A., Shazeer, N., Parmar, N., Uszkoreit, J., Jones, L., Gomez, A. N., ... & Polosukhin, I. (2017). Attention is all you need. Advances in neural information processing systems, 30.
   - 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).
   - Zhang, Y., Murray, A. T., & Turner Ii, B. L. (2017). Optimizing green space locations to reduce daytime and nighttime urban heat island effects in Phoenix, Arizona. Landscape and Urban Planning, 165, 162-171.
   - Ratledge, N., Cadamuro, G., de la Cuesta, B., Stigler, M., & Burke, M. (2022). Using machine learning to assess the livelihood impact of electricity access. Nature, 611(7936), 491-495.
   - Tellman, B., Sullivan, J. A., Kuhn, C., et al. (2021). Satellite imaging reveals increased proportion of population exposed to floods. Nature, 596(7870), 80-86.
   - Paolo, F. S., Kroodsma, D., Raynor, J., et al. (2024). Satellite mapping reveals extensive industrial activity at sea. Nature, 625(7993), 85-91.
   - Additional materials will be provided as required.