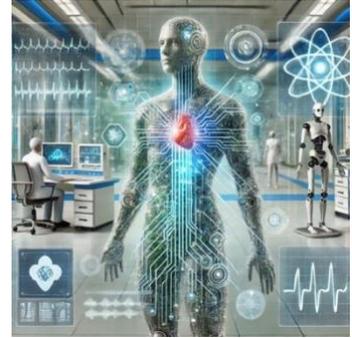**Old Dominion University**
Spring 2026. AI for Health Sciences.
Course Number CS781/CS881/DASC781/DASC881.

Catalogue Description: Artificial Intelligence (AI) has revolutionized health and life sciences by enhancing predictive capabilities, enabling data-driven decision-making, personalized treatments, and improved patient outcomes. This course explores the intersection of AI, healthcare, and biomedical research, covering topics such as medical imaging, genomics, electronic health records (EHRs), large language models, and bioinformatics. Students will gain hands-on experience with agentic AI assisted coding exercises and analysis techniques using platforms like the All of Us Research Program.

Prerequisite: Graduate students with quantitative reasoning. Prior coding experience is not required. The course welcomes students from health and life sciences.

Instructor: Hong Qin, hqin@odu.edu, https://www.lions.odu.edu/~hqin/

Schedule & Location: Online asynchronous.

Office hours: By appointment through ZOOM.

Course Materials (recommended):
- Krohn, J., Beyleveld, G., & Bassens, A. (2019). *Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence*. Addison-Wesley Professional.
- This course offer free-academic DataCamp account. All students will be expected to take relevant DataCamp modules that are relevant to their background and course projects.
- All students are expected take necessary training to access All of Us Research platform.
- Students are recommended to have a ChatGPT account, Google CoLab account, GitHub account.

Course Outline (subject to change)

Week 1: Course Overview, Introduction to AI in Health and Life Sciences
- Overview of AI techniques and applications in healthcare and life sciences

Week 2: AI-assisted Coding Exercises
- Introduction to agentic AI coding and its applications in healthcare

Week 3-4: Machine Learning Fundamentals
- Supervised, unsupervised, and reinforcement learning
- Feature engineering and model evaluation

- Explainable AI approaches
- Assignments:
  - AI assisted exercises with Python libraries (e.g., scikit-learn)

Weeks 5-6: Medical Imaging and Diagnostics
- Image classification, segmentation, and anomaly detection
- Case studies on radiology and pathology
- Assignments:
  - Biomedical image analysis

Weeks 7-9: Genomics and Language Models
- Genomic data analysis using AI techniques, AlphaFold
- Language model and protein design
- Assignments:
  - Predict host and pathogen protein interaction
  - Design new vaccines again viruses

Week 10: All of Us Research Platform
- Overview of the All of Us Research Program
- Data access and analysis using the platform
- Assignments:
  - Conduct a small research project using data from All of Us

Weeks 11-12: Electronic Health Records (EHR) and Natural Language Processing (NLP)
- EHR data preprocessing and feature extraction
- NLP for clinical text analysis
- Assignments:
  - Extract relevant information from EHRs
  - Build a clinical chatbot using NLP

Weeks 1-14: Student Course Projects
- Students choose a domain (e.g., genomics, medical imaging, drug discovery)
- Work on a semester-long project applying AI techniques
- Assignments:
  - Project proposal
  - Mid-term progress report
  - Final project presentation

Student Course Projects

Project Options:
1. **Medical Imaging and Diagnostics**
   - Develop an AI model to classify medical images.
   - Perform anomaly detection on radiology images.
   - Analyze diagnostic results and compare with clinical findings.

2. **Genomics and Personalized Medicine**
    - Predict drug responses based on genetic data.
    - Explore personalized treatment plans using genomic data.
    - Conduct a pharmacogenomics study using AI techniques.
3. **Electronic Health Records (EHR) and NLP**
    - Extract relevant information from EHRs using NLP.
    - Build a clinical chatbot using ChatGPT.
    - Analyze clinical text data to improve patient outcomes.

Evaluation:
- Assignments and Participation: 20%
- Presentations based on primary research papers: 10%x2 papers
- Final course team project: 50% (Proposal: 5%, Progress Report: 20%, Final Report: 25%)
- Final project presentation (team): 10% (record video)

Course Grading Policy will be posted on ODU Canvas.

Final project reports should be written in IEEE format. Students can work as groups with prior approval.

IEEE-Format Final Project Report Rubric

Section	Description	Points
Title & Abstract	Clear, concise, and informative title. Abstract summarizes problem, approach, key results, and conclusions within 150-250 words.	10
Introduction	Background, motivation, problem statement, and objectives clearly articulated. Shows understanding of context and relevance. Ends with a summary of contributions.	15
Methods	Describes methodology, models, algorithms, tools used. Reproducibility and justification of design choices. Includes enough detail to follow and verify.	15
Results	Proper presentation of experimental results or project outcomes. Includes quantitative/qualitative analysis. Matches expectations set in methods.	15
Discussion	Interpretation of results, comparison with expected outcomes or literature. Identifies limitations, challenges, and future directions. Critical thinking evident.	10
References	Proper citation of all sources using IEEE format. Relevant and up-to-date. Minimum required sources (e.g., 5–10).	5
Figures & Tables	All visuals are relevant, well-labeled, and integrated in text. Figures/tables are legible, cited, and referenced correctly. High quality/resolution.	10
Supporting Materials	Submitted code is clean, readable, documented, and runs with provided instructions. Output/log files support report claims.	10
Overall Quality & Effort	Writing clarity, grammar, structure, formatting compliance with IEEE template. Demonstrates effort, professionalism, and thoroughness.	10

Primary Research Paper Presentation Rubric (Total: 100 points)

Criteria	Pts	Excellent (Full Marks)	Good	Satisfactory	Needs Improvement	Poor
Explain the Algorithm / Core Principles	25	23-25: Clear, accurate end-to-end explanation; correct math/technical details; connects method to implementation and goals; appropriate terminology.	19-22: Mostly accurate; minor gaps in details/rationale; some implementation connection.	15-18: Basic understanding; misses several key steps/details; limited implementation link.	8-14: Surface-level; unclear mechanism; important concepts missing/loosely defined.	0-7: Major misunderstandings; incorrect or missing method explanation.
Explain Figures, Tables, and Results	20	18-20: Correctly interprets all key figures/tables; explains axes/metrics/setup; links results to claims; highlights trends and takeaways.	15-17: Most interpreted correctly; minor omissions; some gaps linking results to claims.	11-14: Main results explained; misses insights/assumptions/metrics/baselines/conditions.	5-10: Vague/incomplete; glosses over important figures; weak connection to claims.	0-4: Misinterprets or ignores key results/figures/tables.
Critical Evaluation and Contribution	20	18-20: Balanced critique of assumptions/design/data/evaluation; clear novelty/contribution; discusses impact/limits; proposes meaningful improvements/follow-ups.	15-17: Several strengths/weaknesses; contribution reasonably clear; limited depth on implications/improvements.	11-14: Basic critique; generic at times; misses nuance/broader context.	5-10: Mostly summary; shallow critique; contribution unclear; limited reasoning.	0-4: Little/no critique; unclear or incorrect contribution.
Preparation, Organization, and Delivery	20	18-20: Strong structure (motivation->method->experiments->critique); good pacing/time; smooth transitions; clear slides; confident, rehearsed delivery.	15-17: Generally organized and clear; minor flow/timing issues.	11-14: Adequate but uneven; pacing/clarity issues; some rushed/under-explained parts.	5-10: Disorganized; hard to follow; frequent timing/clarity problems; limited rehearsal evident.	0-4: Unstructured; unclear; major delivery/time issues.
Q&A and Discussion	15	14-15: Accurate, confident answers; explains reasoning; clarifies uncertainties; connects to paper and broader context; extends discussion.	11-13: Answers most accurately; minor hesitation or limited depth.	7-10: Basic answers; partial/uncertain; limited elaboration.	3-6: Often vague/incomplete; struggles to justify or interpret details.	0-2: Unable to address questions or mostly incorrect.
Total	**100**					

Please note:
This syllabus is subject to change with notification on Canvas, email, or other written notification.