New Jersey Institute of Technology

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Spring 2024

Arch 483-008: Special Topics Technology Elective Articicial Intelligence in Architecture

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ARCH483 Special Topics | Technology Elective
ARTIFICIAL INTELLIGENCE IN ARCHITECTURE

Instructor
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Time & Location
Tue/Fri 1:00-2:20 pm, Weston 310 (AIA Room)
Office hours are by appointment only.

Prerequisites
Prerequisites: ARCH 224, ARCH 304, ARCH 314 or (ARCH 323, ARCH 304, ARCH 327).

Description
Recent advances in artificial intelligence (AI) offer new ways for architects to approach design projects by enabling them to generate new ideas, optimize design solutions, and enhance the overall quality of their work. This course will explore how various AI tools can augment the design processes, from conceptual design and ambiental simulation to performance prediction, by integrating cutting-edge technology such as text-to-image (T2I) generators, machine learning (ML), and natural language processing (NLP).

Learning Outcomes
This elective course is designed to give students an exposure to and an understanding of the potential use of emerging artificial intelligence (AI) techniques in architectural design for the generation, analysis and representation of design content. The primary objective is to sharpen critical awareness about the emerging generative AI technologies and the reasons for careful and deliberate methods of design generation and representation of ideas using available AI tools. Students who complete this elective course will have a basic knowledge of various currently available AI tools and techniques and their use in architectural design.

NAAB Student Performance Criteria
The National Architectural Accrediting Board (NAAB) accredits NJIT's architecture program. The NAAB has Program and Student Criteria that must be covered by any architectural curriculum to attain their approval. This course satisfies the following criteria in full or partially:
- **PC.5 Research and Innovation** – How the program prepares students to engage and participate in architectural research to test and evaluate innovations in the field.
- **SC.4 Technical Knowledge** – How the program ensures that students understand the established and emerging systems, technologies, and assemblies of building construction, and the methods and criteria architects use to assess those technologies against the design, economics, and performance objectives of projects.

Instructional Methodology
The first half of the course has a seminar format, whereby each topic is introduced in a lecture followed by a discussion of selected readings. There will be also AI software demonstrations. The second half will have a workshop format in which an AI-related proposal (approved by the instructor) will be researched through a 4,000-word paper or an exploratory term project that could result in a process, technique

and/or product that will be presented at the end. In the second half, there will be regular weekly critiques of the work-in-progress and periodical group reviews.

Though software demonstrations will be given, this elective is not intended as a "how to" course, but rather as an exploration of the conceptual, analytical, representational, and/or practical implications of the use of AI tools in design. It is expected that students will complete the software tutorials on their own, in order to learn the intricacies of various programs that will be introduced.

Term Project and Assignments

There will be regular weekly reading assignments and discussions in the first half of the term. In addition, several assignments will be focused on the use of specific AI tools and their use in the development, analysis and/or representation of design ideas. The results of each assignment will be reviewed and discussed in group sessions.

As a term project, each student will pursue some of the emerging trajectories that were broadly outlined in the first half of the course, and either (a) write a research paper or (b) conduct an exploratory, speculative project that would engage a particular technique or technology and would result in a process and/or product that would be analyzed and summarized retrospectively.

If you opt to do a research paper, you will conduct independent research on a selected (and previously approved) topic related to the use of AI in design, write a 4,000 word paper (about eight pages), and deliver a 15-minute presentation at the end of the term. There will be short, 15-minute long weekly consultations to discuss the progress of your research.

If you decide to do an exploratory project, it is expected that you would engage in an iterative exploration that would involve weekly consultations (also 15-minutes long), i.e. each week you will have to demonstrate progress in developing the project.

At the end of the term, students will deliver a comprehensive presentation that documents the project's development process during the semester and its final outcome.

Textbooks, Equipment, and Software

No textbooks are required for this class. Readings will be assigned on a weekly basis in the first half of the term, and PDFs will be made available if possible. Students are expected to have their own laptop and/or desktop computers. Required software is listed below (additional plugins, as necessary, may be integrated into some exercises):

- Rhinoceros 3D ("Rhino")
- Adobe Creative Cloud Apps (Photoshop, Illustrator, InDesign)
- Midjourney, Stable Diffusion, DALL-E, etc.

Assistance

Although acquiring digital technology skills has a fairly steep learning curve, you will often run into problems with and will have questions about the software and techniques introduced in class. The instructor cannot and will not solve every single step of every problem for you. With software assistance, you will learn, as much as possible, how to find answers and resolve problems using self help, tutorials, the internet, and fellow classmates.

Technical Issues

Problems with a computer (or computers in the computer lab), printers/plotters, laser cutters, flash drives, failure to save or backup, and other technical problems will not be acceptable excuses for late work. Plan ahead for potential problems; develop a plan B. Anticipate problems with crashes, printing/plotting/laser cutting lines, etc. and plan your time accordingly.

Attendance

Attendance at all class sessions and punctuality are expected. Three unexcused absences may lead to a lowering of the final grade by one full letter grade. Late attendance will be noted and count as a partial

absence. All excused absences must be accompanied by an official note or cleared with the instructor prior to the absence.

Expectations

Students are expected to:
- Prepare for, attend, and participate in all class sessions.
- Demonstrate rigor and quality of execution in completing the term project.
- Complete each assignment on time and in a satisfactory manner. Late submission will be penalized half of a letter grade per day.

Extensions and Other Issues

To notify the instructors of an issue impacting your ability to complete coursework on time, or to request an extension, please send an e-mail containing the information in the bullets below. Submission of an e-mail does not guarantee an extension. The instructor commits to responding to e-mail within two weekdays; please plan accordingly. In your message, please include:
- Your full name & student number.
- A brief explanation of the issue.
- Your proposed solution to the issue (i.e. if requesting an extension, suggest a suitable replacement deadline).

Grading

The final grade will be determined based on active participation in discussions (20%), assignments (20%), project's development (25%), final outcome (20%) and its presentation (15%). To receive a passing grade, students must attend at least 80% of all class meetings, complete all assignments in a satisfactory manner, and fulfill minimal requirements for the final presentation of the term project. Interpretation of grades will be as follows:

Grade	Description
A	Superior
B+	Excellent
B	Very Good
C+	Good
C	Acceptable
D	Minimum
F	Inadequate
AUD	Audit
I	Incomplete--given in rare instances to students who would normally have completed the course work but who could not do so because of special circumstances. It is expected that coursework will be completed during the next regular semester. If this grade is not removed before final grades are due at the end of the next regular semester, a grade of F will be issued.
W	Withdrawal
S	Satisfactory
U	Unsatisfactory

Other Notes

- **Learning and Teaching Culture**: In addition to the overarching values and ethics of the university, the New Jersey School of Architecture is dedicated to optimism, diversity and solidarity, professional conduct, constructive evaluation and instruction, collaborative community, health and wellbeing, time management and school-life-work balance, respectful stewardship and space management, and well-rounded enrichment. The pedagogy of architecture and design is as complex as it is rewarding, and as dynamically evolving as the people who learn and teach it. This understanding resides at the core of the NJSOA Learning and Teaching Culture Policy.

- **Canvas**: This course will use the learning management system CANVAS as the repository for all readings assignments and project assignments. All student work must be uploaded in the appropriate assignment folders. To access CANVAS, you must have a UCID account with NJIT.

- **Kepler Archiving:** Students must upload copies of their assignments to the new KEPLER 5 system found under the KEPLER tab in CANVAS "Modules". CANVAS assignments folders are automatically ported to KEPLER, although students will need to initiate a separate KEPLER upload. The new KEPLER has an improved interface for easier batch uploading. Any file, regardless of file size, or type can be uploaded, although .pdfs and .jpegs are recommended to ensure viewability.

- **Academic Integrity**: Academic integrity and honesty are of paramount importance. Cheating and plagiarism will not be tolerated. The NJIT Honor Code will be upheld, and any violations will be brought to the immediate attention of the Dean of Students. All students are responsible for upholding the integrity of NJIT by reporting any violation of academic integrity to the Office of the Dean of Students. The identity of the student filing the report will remain anonymous. All students are expected to adhere to the *University Code on Academic Integrity* link and to the *Code of Student Conduct* link**.**

- **Absences**: The NJIT office of the Dean of Students (DOS) maintains a way for students to explain absences that instructors can use to regulate absenteeism. By providing verifiable documentation through filing an online Student Absence Excuse Request form related to the absences within 14 days, a student can ask for accommodation and that their absences not affect their grade. Once the absence has been verified, the DOS will communicate with the instructor. Nonetheless, the DOS only verifies documentation, and it remains the instructor's discretion to provide any accommodation and the student's responsibility to follow up with the instructor. Accepted reasons for absence include bereavement, medical concerns, military activity, legal obligations, or university-sponsored events.

ARCH483 Special Topics: AI in Architecture
Schedule | Spring 2024

Week 1 | Jan 16 & 19
      Course overview and introductions
      Assignment 1: Text-to-Image Generative AI
Week 2 | Jan 23 & 26
      Lecture & readings discussion
      Generative AI – group presentation (Jan 26)
Week 3 | Jan 30 & Feb 2
      Lecture & readings discussion
Week 4 | Feb 6 & 9
      Lecture & readings discussion
Week 5 | Feb 13 & 16
      Lecture & readings discussion
Week 6 | Feb 20 & 23
      Lecture & readings discussion
Week 7 | Feb 27 & Mar 1
      Project proposals
Week 8 | Mar 5 & 8
      Consultations
Week 9 | No classes – NJIT Spring Break
Week 10 | Mar 19 & 22
      Consultations
Week 11 | Mar 26 (Mar 29 is Good Friday)
      Group presentation
Week 12 | Apr 2 & 5
      Consultations
Week 13 | Apr 9 & 12
      Consultations
Week 14 | Apr 16 & 19
      Project presentations
Week 15 | Apr 23 & 26
      Studio Final Reviews
Week 16 | Apr 30
      Final submission

Note: Schedule is subject to change.