SCHOOL OF ARCHITECTURE GRADUATE AI CERTIFICATE

Graduate Certificate in Artificial Intelligence in Architecture

Dr. Karla Saldana Ochoa

Transcript Title: Certificate in AI in Architecture

Credits: 15 credits

Level: Graduate

CIP Code: 04.0201

Degree Program: Architectural and Building Sciences/Technology

Effective Term: Fall

Effective Year: 2024

CERTIFICATE DESCRIPTION

The AI in Architecture Graduate Certificate offers a comprehensive and logical progression of courses aimed at equipping students with a strong foundation in coding and computation, as well as the theoretical and practical applications of AI and data-driven algorithms in architectural practices. With a comprehensive AI education, our students will gain a competitive edge in the job market. The Certificate will provide accessible, high-quality hybrid AI in Architecture education, making it possible to bridge the AI skills gap and equip students and professionals with the knowledge and skills they need to succeed in this rapidly evolving field.

Students enrolled in the Master of Architecture may add the Graduate Certificate in Artificial Intelligence in Architecture. The certificate shares 9 credit hours with the Master of Architecture degree. It does not add credit hours or time to a track one (advanced program, 52-credit) Master of Architecture degree. The Graduate Certificate in Artificial Intelligence in Architecture when stacked with the Master of Architecture degree requires that the thesis or PILOT required for the Master of Architecture degree be focused on an AI topic.

REQUIREMENTS FOR ADMISSION

- Applicants to this graduate certificate must have earned a bachelor's degree from an accredited US institution or international equivalent in Architecture, Arts, Computer & Information Science & Engineering, Electrical & Computer Engineering, or related fields.

  or

  Current UF graduate students in Architecture, Arts, Computer & Information Science & Engineering, Electrical & Computer Engineering, or related fields are eligible.

  or

  Working professionals in Architecture, Arts, Computer & Information Science & Engineering, Electrical & Computer Engineering, or related fields may apply.

- Applicants must have obtained a bachelor's degree or better and a minimum upper-division GPA of 3.0 from a regionally accredited institution or an international equivalent institution. Students may pursue just the graduate certificate without applying as master's

degree-seeking students within the graduate program. These courses may not be applied to another certificate program (per UF policy).

REQUIREMENTS FOR COMPLETION

Consistent with longstanding Graduate Council policy, the only passing grades for students in a Graduate Certificate program are A, A-, B+, B, B-, C+, C, and S.

All coursework for the Graduate Certificate must meet a minimum overall 3.0 GPA (truncated). Coursework and credits used for a UF Graduate Certificate may also be used to fulfill some requirements for a UF graduate degree, subject to existing Graduate School policy and with the approval of the academic unit offering the graduate degree program. Students will be made aware that only 15 credits taken in the certificate program may potentially be transferred toward a master's degree. As such, they will be strongly encouraged to apply to the master's program before their final semester in the certificate. Otherwise, they will be required to take an additional course in the master's program to fulfill the graduation requirement.

Following traditional Transfer of Credit policy and procedures, up to 6 credits earned with a grade of B or better may be considered for transfer credit toward a future graduate degree provided.

The graduate AI in Architecture Certificate requires **15 credit hours to complete.**

Nine credits are required from the following ARC courses:
ARC 5921 – Fundamentals of Coding and Computation – Spring – 3 credits (Approval #19922)
ARC 6922 – AI & Ethics in Architecture - Fall and Spring – 3 credits (Approval #19816)
ARC 6923 – Machine Learning for Architects – Fall – 3 credits (Approval #19827)

Students can take the remaining 6 credits from any of the following clusters:

Architecture Cluster
ARC 6356 –Advanced Studio III- Fall G3 – 6 credits
ARC 6979 –Master's Research Project– Spring – 6 credits
ARC 6971 – Thesis AI – Spring – 6 credits

Urban Planning Cluster
URP 6271 – Automation for Geospatial Modeling and Analysis Fall – 3 credits
URP 6272 – Urban Spatial Analysis Fall – 3 credits
URP 6276 – Internet Geographic Information Systems Fall – 3 credits

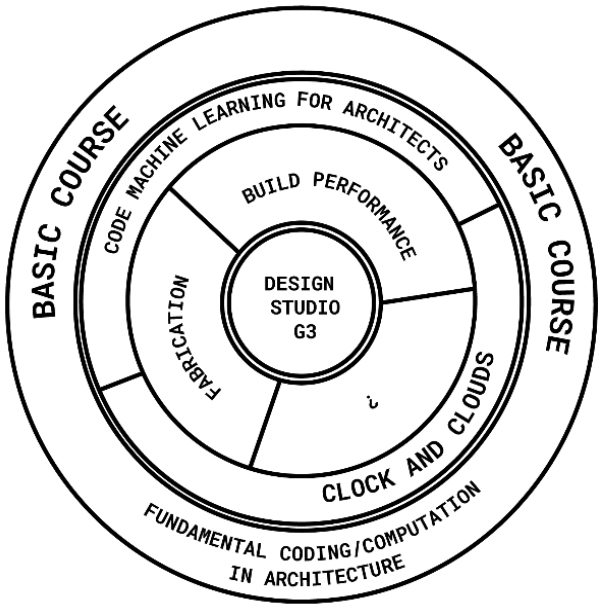
Data Science Cluster

CAP 5771 – Introduction to Data Science - Fall – 3 credits
COT 5405 – Analysis of Algorithms - Spring – 3 credits
COP 5536 – Advanced Data Structures - Spring – 3 credits

Artificial Intelligent Cluster
EEL 5840 – Fundamentals of Machine Intelligence - Spring – 3 credits

RATIONALE AND PLACE IN CURRICULUM

As technology continues to drive the advancement of the built environment, students in the field of architecture could significantly benefit from a strong foundation in AI and its applications. The School of Architecture is committed to providing its students with the skills and knowledge they need to excel academically and in their future careers. Our goal with the AI certificate is to provide graduate students with the opportunity to earn a certificate specializing in AI and Machine Learning applied to the field of Architecture to equip them with the tools they need to succeed in this rapidly evolving field.



CERTIFICATE STRUCTURE

STUDENT LEARNING OUTCOMES

The AI Certificate developed 4 new classes at the School of Architecture to cover subjects ranging from Theory to Practice. The courses meet the requirements identified by the university AI Task Force, with measurable goals and outcomes for future assessment: AI Enrichment, AI Ethics, Use & Apply AI, Evaluate & Create AI. The Student Learning Outcomes are met using the 9 credit hours, 3 of the new courses' coursework

ARC 5921 – Fundamentals of Coding and Computation – 3 credits

This course will teach the fundamentals of coding and computation. During the course, students will understand concepts such as variables, conditions, loops, algorithms, and libraries. The students will then implement these concepts in design exercises to create hands-on projects using coding to solve design problems. (R, A) ARC 6XXX – Machine Learning for Architects – add assignment type and assessment.

ARC 6922– AI & Ethics in Architecture – 3 credits
This course will examine the limitations and opportunities of Bias and Fairness in the practice of architecture using AI. This course fulfills university requirements to be categorized as “AI Ethics.” Students will construct theoretical and philosophical questions related to AI and data-driven algorithms in design and will examine bibliographic works to support their hypotheses in response to the questions. In their final project, students will create course syllabi for the first year of architecture studies, taking AI as a ground infrastructure in the curriculum.

ARC 6923– Machine Learning for Architects - 3 credits
This course will focus on experimentation and application. Students will apply the most common state-of-the-art AI and Machine Learning (ML) algorithms and game engines in architectural design. Emphasizing AI as a paradigm for critical thinking and idea development, not just optimization. This course will fulfill university requirements to be categorized as “Use & Apply AI. The remaining 6 credits add additional reinforcement within a range range of outcomes.

ARC 6356 Advanced Studio III - 6 credits
This design studio course is fundamental to architectural education. Students will combine different AI algorithms to create solutions for real-world design projects. This course will fulfill university requirements to be categorized as “Use & Apply AI.”
PILOT projects or the Final Thesis: Students can develop research projects utilizing AI applications for their PILOT or Thesis. The credits can be counted towards the AI and Architecture Certificate if the projects include a section utilizing AI. This course fulfills university requirements to be categorized as "Use & Apply AI."
To ensure a well-rounded curriculum, other courses will be outsourced from other schools within the University of Florida (UF), such as the College of Arts, and the College of Engineering. These courses will delve into the specific application of AI in different areas, such as engineering, data science, fabrication, building performance, theater, art, music, etc. These courses will fulfill the “Evaluate & Create AI” category requirements.

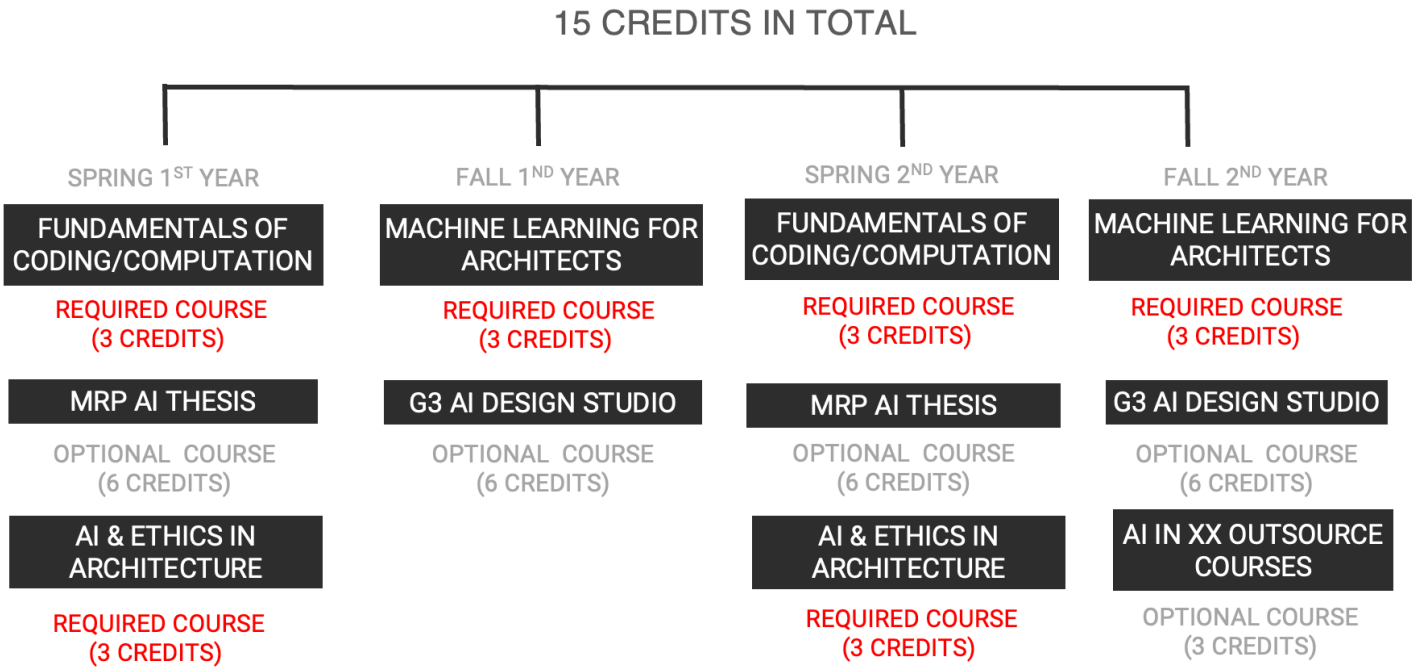
Outcome Map Key:
I = Introduced
E = Emphasized R = Reinforced A = Advanced

Students solve design problems by applying code (AI Enrichment). (I, E)
ARC 5XXX – Fundamentals of Coding and Computation.

Students critically evaluate theoretical and philosophical questions in (design) architectural practices raised by AI and data-driven algorithms (AI Ethics).
(I, E) ARC 6XXX – Clock and Clouds.
(R, A) ARC 6XXX – Machine Learning for Architects.

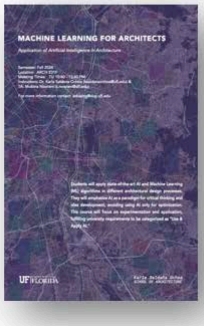
Students devise approaches to solve architectural design problems by applying state-of-the-art AI and Machine Learning (ML) algorithms (Use & Apply AI).
ARC 5XXX – Fundamentals of Coding and Computation (E, R)
ARC 6XXX – Machine Learning for Architects

Students propose and design AI research methods to approach viable architectural design questions (Evaluate & Create AI).
ARC 5XXX – Fundamentals of Coding and Computation
(E) ARC 6XXX – Clock and Clouds
(R, A) ARC 6XXX – Machine Learning for Architects



COURSE CONTENT AND POSTERS

ARC 5XXX - Fundamentals of Coding and Computation: This core course will delve into the fundamentals of coding, introducing students to concepts such as variables, conditions, loops, algorithms, and libraries. These concepts will then be applied in design exercises to give students a hands-on understanding of how coding can solve design problems. This course will fulfill university requirements to be categorized as **"AI Enrichment".**



ARC 6XXX Machine Learning for Architects: The course will focus on experimentation and application. Students will learn about the most common AI and Machine Learning (ML) algorithms used in design exercises and how they can apply them in architectural design. This course will fulfill university requirements to be categorized as **"Use & Apply AI".**

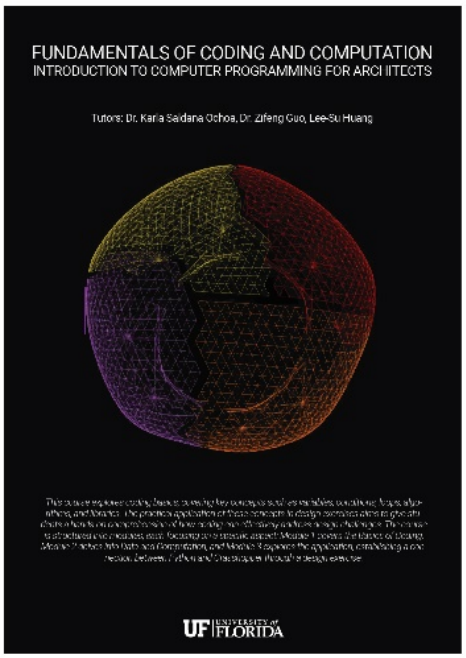
ARC 6XXX – Clocks and Clouds: This course fulfills university requirements to be categorized as an **"AI Ethics"** course. Students will explore and evaluate the use of AI and data-driven algorithms in architectural practices. They will develop course syllabi for the first year of architecture studies, taking AI as a ground infrastructure in the curriculum, addressing fairness, bias, and copyright for work produced with AI

ARC 6356 Fluid–on water and land: This is a foundational course within architectural education. This course will challenge students to apply their knowledge and skills acquired from previous courses to real-world design projects. This course will fulfill university requirements to be categorized as **"Use & Apply AI"**

FUNDAMENTALS OF CODING AND COMPUTATION

Introduction to Computer Programming for Architects

ARC 5921:
Class Periods: TBD
Location: TBD
Academic Term: Spring 2025



Instructor:
Karla Saldana Ochoa
ksaldanaochoa@ufl.edu
+1 352 294 1453
Office Hours: TBD

Course Description

- Architecture students will **learn** the fundamentals of coding and computation. During the course, students will **understand** concepts such as variables, conditions, loops, algorithms, and libraries. The students will then **implement** these concepts in design exercises to **create** hands-on projects using coding to solve design problems. This course will fulfill university requirements to be categorized as **" Use & Apply AI".**

Course Pre-Requisites / Co-Requisites

Applicants must have obtained a bachelor's degree or better and a minimum upper-division GPA of 3.0 from a regionally accredited institution.

Course Objectives

1. Applying:
    - Implement coding techniques to create solutions for design exercises.
    - Utilize coding languages and tools to develop hands-on projects addressing various design problems.
    - Apply coding skills to translate design concepts into executable programs.
2. Analyzing:
    - Evaluate the effectiveness of different coding strategies in solving design challenges.
    - Analyze coding solutions to identify strengths and weaknesses in addressing specific design problems.
    - Compare and contrast various coding approaches and their applications in design contexts.
3. Evaluating:
    - Assess the appropriateness of coding solutions in addressing design requirements.
    - Judge the effectiveness of coding techniques in achieving desired design outcomes.
4. Creating:

- Generate innovative coding solutions to design problems.
- Design and develop original projects integrating coding and design principles.
- Synthesize coding skills with design concepts to create novel solutions that push the boundaries of traditional architectural practices.

Materials and Supply Fees

None

Required Textbooks and Software

- Google Colab
- Google Drive
- Rhino
- Grasshopper
- Daniel, Kahneman. "Thinking, fast and slow." (2017).
- Russell, Stuart. Human compatible: Artificial intelligence and the problem of control. Penguin, 2019.
- Hole, Kjell Jørgen, and Subutai Ahmad. "A thousand brains: toward biologically constrained ai." SN Applied Sciences 3.8 (2021): 1-14.
- Hovestadt, Ludger. On Digital Architecture in Ten Books: A Tractatus. Vol. 1, Books 1-3. Applied Virutality Book Series. Boston: De Gryuter, 2022.
- Hovestadt, Ludger.. On Digital Architecture in Ten Books: A Tractatus. Vol. 2, Books 4-6. 1st ed. Boston: De Gryuter, 2022.
- Saldana Ochoa K (2021). Event Protocols: Enhancing Disaster Response with Architectonics Capabilities by leveraging human and Artificial Intelligence Interplay. Doctoral Thesis. ETH Zurich.
- Bühlmann et al. Ethics of Coding: A Report on the Algorithmic Condition, 2017.

Course Schedule

Week 1 - **What is coding?**
Week 2 - **Variables, Functions, and Libraries**
Week 3 - **Conditionals. If-Else Statements**
Week 4 - **Loops. For-loops**
Week 5 - **Data Structures. Low-Level Data Structuring**
Week 6 - **Data Structures. High-Level Data Structuring**
Week 7 - **Algorithms**
Week 8 - **Application-oriented libraries**
Week 9 - **Guest Lecture**
Week 10 - **Spring Break NO CLASSES**
Week 11 - **GHPython and Grasshopper link**
Week 12 - **Working with geometry: Examples and case studies.**
Week 13 - **Read/Write data, GH components**
Week 14 – 15 – **Final Project Preparation**
Week 16 - **Final Project Presentation.**

Attendance Policy, Class Expectations, and Make-Up Policy

Excused absences must be consistent with university policies in the Graduate Catalog (http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#attendance) and require appropriate documentation. Additional information can be found here: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Homework Sets (10)	100 each	15%
Quizzes (4)	100 each	10%
Midterm Exam	100	15%
Final Exam	100	50%
Attendance	100	10%
		100%

Attendance Policy, Class Expectations, and Make-Up Policy

Attendance is mandatory. Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies.

Grading Policy

	Letter Grade	Numeric Grade	Quality Points	Qualitative Description
PASSING GRADES	A	93 - 100	4.0	Outstanding work only
	A-	90 – 92.9	3.67	Close to outstanding
	B+	87 - 89.9	3.33	Very good work
	B	84 – 86.9	3.0	Good work
	B-	80 – 83.9	2.67	Good work with some problems
	C+	77 - 79.9	2.33	Slightly above average work
	C	74 – 76.9	2.0	Average work
FAILING GRADES	C-	70 - 73.9	1.67	Average work with some problems
	D+	67 - 69.9	1.33	Poor work with some effort
	D	64 - 66.9	1.0	Poor work
	D-	61 - 63.9	0.67	Poor work with some problems
	E	0. - 60.9	0.0	Inadequate work

More information on UF grading policy may be found at:
UF Graduate Catalog
Grades and Grading Policies

Students Requiring Accommodations
Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the Disability Resource Center. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation
Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Click here for guidance on how to give feedback in a professional and respectful manner. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students here.

Distance Learning Privacy Policy
Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

In-Class Recording
Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, and exams), field trips, and private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code specifies a number of behaviors that are in violation of this code and the possible sanctions. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Students in the School of Architecture are expected to adhere to all University of Florida academic honesty policies. Failure to do so will result in lowered grades and/or referral to the University Honor Court. Since the University's policies are necessarily generalized, the School of Architecture further clarifies academic honesty within the specific setting of design education. The following acts are considered to be academic dishonesty:

1. **Plagiarism/misrepresentation**

   There shall be no question of what your work is and what someone else's is. This applies to all aspects of student performance, including but not limited to
   - CAD drawings and construction details
   - design guidelines (written and graphic)
   - design, planning, and management projects or portions of projects
   - class reports and papers (again, both written and graphic information)
   - any assignment where sole authorship is indicated, such as take-home tests, individual projects, etc.

   Examples of inappropriate activities include:
   - copying graphics for a report without crediting the original source
   - representing someone else's work as your own (using existing CAD construction details, tracing drawings, etc.)
   - allowing someone else to represent your work as his own

   The importance of precedent and learning from past works is a necessary part of most design processes. Again, it is the intent and degree of "borrowing" ideas that is at question.

Anything not original must be paraphrased and cited, or quoted; using accepted style formats such as APA, MLA, Chicago Manual of Style, etc. This includes information obtained from the Internet, public documents, graphics, and personal interviews as well as more traditional written sources. Proper crediting of all information that is not common knowledge is necessary for academic honesty as well as for professionalism. (For example, analysis drawings and/or text should cite the sources from which data was obtained so that if questions arise later, they can be quickly and accurately answered.)

Multiple submissions of the same or similar work without prior approval
If the instructors understand that you are doing a paper associated with your thesis or senior project topic, then doing similar work for two different classes is acceptable—if the instructors agree to it. If a single paper is submitted for one class, then later is submitted for another, and the instructors expect original work, then the multiple submission is inappropriate.

2. **Falsifying information**

Examples include:

- misrepresenting reasons why work cannot be done as requested
- changing or leaving out data, such as manipulating statistics for a research project, or ignoring/hiding inconvenient but vital site information. (However, for educational purposes only, certain aspects of the "real world" may be jointly agreed upon as not being pertinent to the academic goals of the course, such as not dealing with specific project parameters or budget, changing the program, etc.)
- altering work after it has been submitted
- hiding, destroying, or otherwise making materials unavailable (hiding reference materials, not sharing materials with other students, etc.)

Software Use
All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy
There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see the Notification to Students of FERPA Rights.

Campus Resources:

Health and Wellness

U Matter, We Care:
If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student, or visit U Matter, We Care website to refer or report a concern and a team member will reach out to the student in distress.

Counseling and Wellness Center: counseling.ufl.edu/cwc, and 392-1575 for information on crisis services as well as non-crisis services; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or police.ufl.edu.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling.

Library Support, Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.

Student Complaints Campus, Visit the Student Honor Code and Student Conduct Code webpage for more information.

On-Line Students Complaints, View the Distance Learning Student Complaint Process

Orlando Resources

Police / Fire / Medical Emergency – 911
Orlando Police Department Non-Emergency Number: 321.235.5300
Consult CityLab-Orlando Student Resources for Emergency contact information.

AI & ETHICS IN ARCHITECTURE

ARC 6922:
Class Periods: TBD
Location: TBD
Academic Term: Spring 2025

Instructor:
Karla Saldana Ochoa
ksaldanaochoa@ufl.edu
+1 352 294 1453
Office Hours: TBD

Course Description

E**xamines** the limitations and opportunities of Bias and Fairness in architecture using AI. It fulfills university requirements to be categorized as **"AI Ethics."** Students will **construct** theoretical and philosophical questions related to AI and data-driven algorithms in design and will examine bibliographic works to support their responses. Finally, students will **create** course syllabi for a design studio, with AI as infrastructure in the curriculum.

Course Pre-Requisites / Co-Requisites

Applicants must have obtained a bachelor's degree or better and a minimum upper-division GPA of 3.0 from a regionally accredited institution.

Course Objectives

1. Understanding:
    - Explain the analogies of clocks and clouds and how they relate to the topics of bias and fairness in architecture with AI.
    - Interpret the ethical implications of bias and fairness in the context of AI-driven architectural design.
2. Applying:
    - Utilize the analogies of clocks and clouds to analyze real-world architectural scenarios and identify instances of bias and fairness concerns.
    - Construct theoretical and philosophical questions related to AI and data-driven algorithms in architectural design.
3. Analyzing:
    - Evaluate the limitations and opportunities presented by bias and fairness in architecture using AI through the analogies of clocks and clouds.
    - Analyze bibliographic works to identify trends and perspectives on AI ethics in architectural practice.
4. Evaluating:
    - Assess the ethical implications of bias and fairness considerations in architectural design with AI.

5. Creating:
    - Synthesize theoretical frameworks with practical applications to propose a design studio syllabus for the first year in architecture to address bias and fairness in architectural design with AI.

Materials and Supply Fees
None

Required Textbooks and Software

- Chung, Inaba, J., Koolhaas, R., Leong, S. T., & Cha, T. (2001). 'Air-Conditioning' in Harvard Design School guide to shopping. Taschen: pp. 93-125.
- Korzybski, A. (1931). A non-Aristotelian system and its necessity for rigor in mathematics and physics.
- Popper, Karl. Three worlds. Ann Arbor: University of Michigan, 1979.
- Louis Marin, 'The City in Its Map and Portrait', in Werner Hamacher and David E. Welbery (eds) On Representation: Louis Marin, trans. Catherine Porter (Stanford: Stanford University Press, 2001): pp. 202-218.
- Aureli, Pier Vittorio, and Maria Shéhérazade Giudici. "Islands." Log 47 (2019): 175-199.
- Saldana Ochoa K (2021). Event Protocols: Enhancing Disaster Response with Architectonics Capabilities by leveraging human and Artificial Intelligence Interplay. Doctoral Thesis. ETH Zurich.
- Sarkis, H., Kozlowski, G., & Barrio, R. S. (2019). The world as an architectural project. MIT.
- Christian, Brian. The alignment problem: Machine learning and human values. WW Norton & Company, 2020.
- Daniel, Kahneman. "Thinking, fast and slow." (2017).
- Russell, Stuart. Human compatible: Artificial intelligence and the problem of control. Penguin, 2019.
- Hole, Kjell Jørgen, and Subutai Ahmad. "A thousand brains: toward biologically constrained ai." SN Applied Sciences 3.8 (2021): 1-14.
- Brillouin, Léon. Science and Information Theory. Second edition. Mineola, New York: Dover Publications, Inc, 2013.
- Bühlmann, Vera. Mathematics and Information in the Philosophy of Michel Serres. London: Bloomsbury Publishing Plc, 2020.
- Buhrmann et al. Ethics of Coding: A Report on the Algorithmic Condition, 2017.
- Clément, Gilles. Gardens, Landscape and Nature's Genius. Translated by Elzélina Van Melle. IKAROS Lanscape Series. Aarhus: IKAROS Press, 2020.
- Hovestadt, Ludger. On Digital Architecture in Ten Books: A Tractatus. Vol. 1, Books 1-3. Applied Virutality Book Series. Boston: De Gryuter, 2022.
- Hovestadt, Ludger.. On Digital Architecture in Ten Books: A Tractatus. Vol. 2, Books 4-6. 1st ed. Boston: De Gryuter, 2022.
- Hovestadt et al. (eds.), Atlas of Digital Architecture. Birkhäuser, 2022.
- Huy, Yuk. "ChatGPT, or the Eschatology of Machines" in E-Flux #137, 2023.
- Popper, Karl R. 'Of Clouds and Clocks. An Approach to the Problem of Rationality and the Freedom of Man.' In Objective Knowledge: An Evolutionary Approach, Rev. ed., 206–55. Oxford [Eng.] : New York: Clarendon Press ; Oxford University Press, 1979.
- Villa, Riccardo M. 'Gardening, Imaginal, Tokos'. In Architecture and Naturing Affairs, edited by Ludger Hovestadt and Mihye An, 61–63, 145–48. Applied Virtuality 15. Birkhäuser, 2020.

- Villa, Riccardo M.. 'Upon Entropy Architecture and Image in the Age of Information'. Application/pdf. TU Wien, 2022. https://doi.org/10.34726/HSS.2022.60031.

Course Schedule

Week 1 - **Introduction: Artificial Intelligence and Architectonic Disposition.**
Week 2- **How to operate with Double Articulations.**
Week 3 - **AI as Tools and Instruments Assignment 1**
Week 4 - **Introduction to Entropy and Negentropy and the Relationship with Data and Information.**
Week 5 - **Map and Models. Assignment 2**
Week 6 - **Landscape and Gardens**
Week 7 - **Midterm**
Week 8 - **Guest Lecture**
Week 9 - 12 **Workshop to develop a final project. Assignment 3**
Week 13 - **Round Table Discussion**
Week 14 - **Final Project Presentation**
Week 15 - **Revision and Final Submission**

Assignment 1: Develop a course exercise using a doble articulation approach.
Assignment 2: Develop a course exercise using the map and model analogy.
Midterm: Present the 3 class exercises: Doble articulation, map and model, and landscape and garden
Assignment 3: Develop a course exercise using any of the following analogies: tool and instrument, entropy and negentropy.

Attendance Policy, Class Expectations, and Make-Up Policy
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		100%

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	C	74 – 76.9	2.0	Average work
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A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, and exams), field trips, and private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

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integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Students in the School of Architecture are expected to adhere to all University of Florida academic honesty policies. Failure to do so will result in lowered grades and/or referral to the University Honor Court. Since the University’s policies are necessarily generalized, the School of Architecture further clarifies academic honesty within the specific setting of design education. The following acts are considered to be academic dishonesty:

1. **Plagiarism/misrepresentation**

   There shall be no question of what your work is and what someone else’s is. This applies to all aspects of student performance, including but not limited to
   - CAD drawings and construction details
   - design guidelines (written and graphic)
   - design, planning, and management projects or portions of projects
   - class reports and papers (again, both written and graphic information)
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   The importance of precedent and learning from past works is a necessary part of most design processes. Again, it is the intent and degree of “borrowing” ideas that is at question.

   Anything not original must be paraphrased and cited, or quoted; using accepted style formats such as APA, MLA, Chicago Manual of Style, etc. This includes information obtained from the Internet, public documents, graphics, and personal interviews as well as more traditional written sources. Proper crediting of all information that is not common knowledge is necessary for academic honesty as well as for professionalism. (For example, analysis drawings and/or text should cite the sources from which data was obtained so that if questions arise later, they can be quickly and accurately answered.)

   Multiple submissions of the same or similar work without prior approval
   If the instructors understand that you are doing a paper associated with your thesis or senior project topic, then doing similar work for two different classes is acceptable—if the instructors agree to it. If a single paper is submitted for one class, then later is submitted for another, and the instructors expect original work, then the multiple submission is inappropriate.

2. **Falsifying information**

Examples include:

- misrepresenting reasons why work cannot be done as requested
- changing or leaving out data, such as manipulating statistics for a research project, or ignoring/hiding inconvenient but vital site information. (However, for educational purposes only, certain aspects of the "real world" may be jointly agreed upon as not being pertinent to the academic goals of the course, such as not dealing with specific project parameters or budget, changing the program, etc.)
- altering work after it has been submitted
- hiding, destroying, or otherwise making materials unavailable (hiding reference materials, not sharing materials with other students, etc.)

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

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Library Support, Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.

Student Complaints Campus, Visit the Student Honor Code and Student Conduct Code webpage for more information.

On-Line Students Complaints, View the Distance Learning Student Complaint Process

Orlando Resources

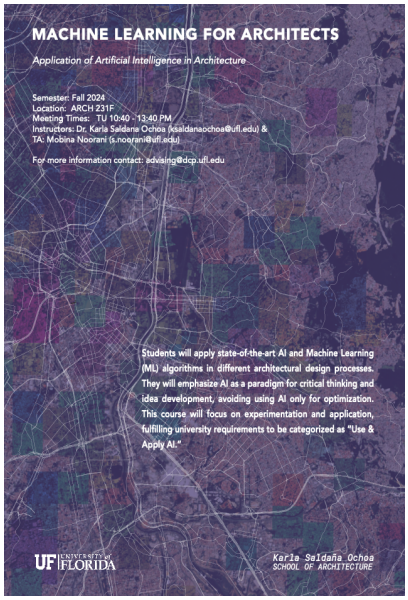
Police / Fire / Medical Emergency – 911
Orlando Police Department Non-Emergency Number: 321.235.5300
Consult CityLab-Orlando Student Resources for Emergency contact information.

MACHINE LEARNING FOR ARCHITECTS

ARC 6922:
Class Periods: TBD
Location: TBD
Academic Term: Fall 2025

Instructor:
Karla Saldana Ochoa
ksaldanaochoa@ufl.edu
+1 352 294 1453
Office Hours: TBD

Teaching Assistants:
Mobina Noorani



Course Description
Students will apply state-of-the-art AI and Machine Learning (ML) algorithms in different architectural design processes. They will emphasize AI as a paradigm for critical thinking and idea development, avoiding using AI only for optimization. This course will focus on experimentation and application, fulfilling university requirements to be categorized as **"Use & Apply AI."**

Course Pre-Requisites / Co-Requisites
Applicants must have obtained a bachelor's degree or better and a minimum upper-division GPA of 3.0 from a regionally accredited institution.

Course Objectives

1. Remembering:
    - Recall the fundamental principles of AI and machine learning algorithms.
2. Understanding:
    - Explain the theoretical foundations behind AI and machine learning algorithms.
    - Interpret how AI and ML algorithms are utilized in architectural exercises.
    - Summarize the significance of AI and ML in architectural innovation.
3. Applying:
    - Implement common AI and ML algorithms to address architectural challenges.
4. Analyzing:
    - Evaluate the effectiveness of different AI and ML algorithms in architectural applications.
5. Evaluating:
    - Assess the performance of AI and ML models in addressing architectural requirements.
6. Creating:
    - Generate innovative architectural designs using AI, ML algorithms, and game engines.

Materials and Supply Fees
None

Required Textbooks and Software

- Google cola
- Google drive

- Saldana Ochoa K (2021). Event Protocols: Enhancing Disaster Response with Architectonics Capabilities by Leveraging Human and Artificial Intelligence Interplay. Doctoral Thesis. ETH Zurich.
- Daniel, Kahneman. "Thinking, fast and slow." (2017).
- Russell, Stuart. Human compatible: Artificial intelligence and the problem of control. Penguin, 2019.
- Hole, Kjell Jørgen, and Subutai Ahmad. "A thousand brains: toward biologically constrained ai." SN Applied Sciences 3.8 (2021): 1-14.
- Bühlmann et al. Ethics of Coding: A Report on the Algorithmic Condition, 2017.

Course Schedule

Week 1 **AI and Machine Learning**
Week 2-3 **Data Collection, Assignment 1 due**
Week 4 - 5 **Data Visualization, Feature Extraction methods,**
Week 6 **Unsupervize Learning - Midterm reviews Assignment 2 due**
Week 7 **Supervized learning - Creating a training data**
Week 8 **Computer vision algorithms, Assignment 3 due**
Week 9-10 **Generative algorithms**
Week 13 -15 **Design Workshop**
Week 16 **Final Submissions**

Assignment 1: Collect Data from existing websites using the materials taught in class and preprocess the collected data.
15 points

Assignment 2: Train unsupervised clustering algorithms with the collected data.
15 points

Assignment 3: Apply Computer vision algorithms to detect objects from images collected with your phone
15 points

Final Submissions: Develop a project choosing an AI algorithm

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