

ICSI 445/660

Introduction to Digital Media Forensics

(Fall 2019)

Class Meeting Time: T 8:45-11:35AM

Location: Husted 214



INSTRUCTOR

Instructor's name	Siwei Lyu
Instructor's title	Associate Professor
Office location	UAB 413
Office hours	MWF 12:00a-1:00p or by appointment
E-mail address	slyu@albany.edu

TEACHING ASSISTANTS

TA	TBA
TA's office location	TBA
TA's office hours	TBA
TA's email addresses	TBA

REQUIRED TEXTBOOK

We do not use a textbook, all should be based on the lecture slides of the instructor

COURSE DESCRIPTION / OVERVIEW

The widespread adoption of digital content over traditional physical media such as film has given rise to a number of new information security challenges. Digital content can be altered, falsified, and redistributed with relative ease by adversaries. This has important consequences for governmental, commercial, and social institutions that rely on digital information. The pipeline which leads to ascertain whether an image has undergone to some kind of forgery leads through the following steps: determine whether the image is "original" and, in the case where the previous step has given negative results, try to understand the past history of the image. Although the field of information forensics is still young, many forensic techniques have been developed to detect forgeries, identify the origin, and trace the processing history of digital multimedia content. This course provides an overview of information forensics research and related applications. Also we examine the device-specific fingerprints left by digital image and video cameras

along with forensic techniques used to identify the source of digital multimedia files. Finally, an overview of the recent trends and evolution, considering the updated literature in the field, will be provided.

PREQUISITES

the prerequisite to this class is very important, and lack of knowledge of these subjects will make difficult to make positive progress in the class. There will be an entrance exam to test the readiness of this class.

- Machine Learning (CSI 436/536 or equivalent).

COREQUISITES

None

LEARNING OBJECTIVES / OUTCOMES

This course will enable students to:

- describe forensics systems for commercial and scientific imaging applications
- explain how imaging data are processed and how proceed to detect forgeries
- list specifications and requirements to select a specific algorithm for your imaging application in the forensics context
- recognize performance differences among imaging pipeline technologies
- become familiar with current and future imaging technologies and applications

TENTATIVE LIST OF TOPICS TO BE COVERED

- Physics- and geometric-based forensic techniques (vanishing points, reflections, shadows, lens flare)
- Sensor-based forensic techniques (color filter array, photo response non-uniformity)
- File-based techniques (Meta-data, JPEG signatures)
- Pixel based forensic techniques (double compression, JPEG dimples, region cloning)
- Computer-synthesized content detection (CG generated imagery, AI-synthesis)

COURSE WEBSITE AND BLACKBOARD

Blackboard will be used to provide essential course materials, the most current syllabus, and assignment documents and no separate course website will be maintained. However, this is not an online course and class attendance and participation is essential and required.

ASSESSMENT AND POLICIES

The accomplishment of course objectives will be assessed by applying the concepts and tools for engineering design in a combination of team and individual assignments/labs/projects, tests, and a final project that includes research and design, a written component, and an oral presentation.

Exams: Two exams will be given. A portion of the class period preceding each exam will be utilized for a review session. There is /is not a final exam during finals week.

Project / Labs / Assignment: Projects / labs / assignments will be assigned and will be conducted both out of class and during lab period. They will be graded on a 100-point scale and will be totaled together to account for 30% of the final grade.

Final Project: A final project will/will not be required. The requirements for this assignment will be fully described in a Blackboard later in the course.

Grading

A final grade will be determined as a weighted average of these scores using the following weights:

- 20% in class quizzes
- 30% homework assignments
- 20% midterm exam
- 30% final project

Grading Scale

- A: 100-95 points A-: 94-90 points
- B+: 89-87 points B: 84-86 points B-: 80-83 points
- C+: 79-76 points C: 75-70 points
- D: 69-60 points
- E: 59 points and below

Students must complete all requirements in order to pass the course. A grade of incomplete will be given only when circumstances beyond the student's control cause a substantial amount of course work to be unfinished by the end of the semester. Whenever possible, the student is expected to make extra efforts to prevent this situation from occurring. The instructor will be the sole judge of whether an incomplete is warranted. Final grades are computed based on the above formulas and are NOT negotiable. Per department policy, "...students may not submit additional work or be re-examined for the purpose of improving their grades once the course has been completed and final grades assigned." purpose of improving their grades once the course has been completed and final grades assigned."

ATTENDANCE

Students are expected to attend every class and to arrive on time. Please DO NOT disrupt the class by entering late or leaving early without instructor approval. Attendance will be taken at every class meeting.

Although it is not part of the final grade, consistently missing classes will cause degraded performance of your final grade: one “no show” without legitimate explanation that is caused by uncontrollable or unavoidable reasons in class will lead to a 30% reduction of total final grades; twice and more will lead to an F grade to the class. If you know that it will be difficult for you to consistently get to class on time and stay for the entire period, you should take this course at a time that better fits your schedule. Computers may be used during class for note taking as long as the use is not disruptive or distracting. Also see http://www.albany.edu/health_center/medicaexcuse.shtml.

LATE HOMEWORK TURNINS

Homework turned in before or on the specified due date and time, in class or submitted through Blackboard, depending on the circumstance, are eligible for 100% of the grade. If you choose to turn in after the due date and time passes, for the first 24 hour period after the due date and time, your assignment will be eligible for 50% of the full grade; after that, your assignment will be eligible for 0% of the full grade.

WITHDRAWAL WITHOUT PENALTY

Please pay attention to the drop date, which is the last date you can drop this course with no financial consequence. After that, you should consult the university’s liability schedule (<http://www.albany.edu/studentaccounts/liability.php>) to consider dropping from this class. This may happen when you have to miss many assignments for unforeseeable scenarios. IMPORTANT: It is your responsibility to take such an action by this date, and don’t wait until it’s too late to see us when you get in trouble.

INCOMPLETE AND EXTRA CREDIT POLICY

As per the Undergraduate Bulletin, the grade of Incomplete (I) will be given "only when the student has nearly completed the course requirements but because of circumstances beyond the student's control the work is not completed." A student granted an incomplete will make an agreement specifying what material must be made up, and a date for its completion. The incomplete will be converted to a normal grade on the agreed upon completion date based upon whatever material is submitted by that time. The instructor will be the sole judge of whether an incomplete is warranted. IMPORTANT: Incomplete will not be given to students who have not fulfilled their classwork obligations, and who, at the end of the semester, are looking to avoid failing the course. There will be no extra credit work. All students will be expected to complete, and be graded on, the same set of assignments.

NON-CLASS RELATED USE OF TECHNOLOGY

Use of electronic devices (cell phone, tablets, personal laptop computers) for non-class purposes while the class is in session is not allowed. If this is violated in a consistent manner after initial warning is issued by the instructor, the student involved will be treated as unexcused missing the day’s class.

RESPONSIBLE COMPUTING

Students are required to read the University at Albany Policy for the Responsible Use of Information Technology (https://www.albany.edu/its/its_policies.htm). Students will be expected to apply the policies discussed in this document to all computing and electronic communications in the course.

STUDENTS WITH DISABILITIES

Reasonable accommodations will be provided for students with documented physical, sensory, systemic, cognitive, learning and psychiatric disabilities. If you believe you have a disability requiring accommodation in this class, please notify the Director of the Disability Resource Center (Campus Center 130, 442-5490). That office will provide the course instructor with verification of your disability, and will recommend appropriate accommodations. For further information refer to the University's Disclosure Statement regarding Reasonable Accommodation found at the bottom of the document at the following website: <http://www.albany.edu/disability/docs/RAP.doc>. This website can be reached by following the link under "Reasonable Accommodation Policy" at the following webpage <http://www.albany.edu/disability/faculty-staff.shtml>.

ACADEMIC HONESTY AND OVERALL REGULATIONS

Every student has the responsibility to become familiar with the standards of academic integrity at the University. Faculty members must specify in their syllabi information about academic integrity, and may refer students to this policy for more information. Nonetheless, student claims of ignorance, unintentional error, or personal or academic pressures cannot be excuses for violation of academic integrity. Students are responsible for familiarizing themselves with the standards and behaving accordingly, and UAlbany faculty are responsible for teaching, modeling and upholding them. Anything less undermines the worth and value of our intellectual work, and the reputation and credibility of the University at Albany degree. Plagiarism and other acts of academic dishonesty will be punished. Read the Standards of Academic Integrity and policies in the University Bulletin (https://www.albany.edu/undergraduate_bulletin/regulations.html).

CAUTION AND A STRONG WORD OF WARNING!!!! *Plagiarism and other acts of academic dishonesty will be punished. Students are expected to submit original work. While you may discuss a problem with another student, the work you submit must be your own. Any student who submits copied work or any student that provides work for copying will earn a zero grade for that assignment. If there is more than one copying incident, the student will be graded an E for the class. As per college policy, cheating activity, including cheating in exams, quizzes, projects, etc., WILL be written up in a Violation of Academic Integrity Report (VAIR) reported to the college administration, which includes the Computer Science Chair, the College of Engineering and Applied Sciences Dean, and the Vice Provost of Undergraduate Studies. This will become a part of your permanent record. Multiple incidents will result in being expelled from the college.*

SEXUAL VIOLENCE PREVENTION AND RESPONSE POLICIES

Title IX of the Education Amendments of 1972 is a federal civil rights law that prohibits discrimination on the basis of sex in federally funded education programs and activities.

The SUNY-wide Sexual Violence Prevention and Response Policies prohibit offenses defined as sexual harassment, sexual assault, intimate partner violence (dating or domestic violence), sexual exploitation, and stalking. The SUNY-wide Sexual Violence Prevention and Response Policies apply to the entire University at Albany community, including students, faculty, and staff of all gender identities. The University at Albany provides a variety of resources for support and advocacy to assist individuals who have experienced sexual offenses.

Confidential support and guidance can be found through the Counseling Center (518-442-5800, https://www.albany.edu/counseling_center/),

the University Health Center (518-442-5454, https://www.albany.edu/health_center/), and the Interfaith Center (518-489-8573, <https://www.albany.edu/spirituality/onCampus.shtml>). Individuals at these locations will not report crimes to law enforcement or university officials without permission,

except for in extreme circumstances, such as a health and/or safety emergency. Additionally, the Advocates at the University at Albany’s Advocacy Center for Sexual Violence are available to assist students without sharing information that could identify them (518-442-CARE, <https://www.albany.edu/advocacycenter/>).

Sexual offenses can be reported non-confidentially to the Title IX Coordinator within The Office for Equity and Compliance (518-442-3800, <https://www.albany.edu/equity-compliance/>, Building 25, Room 117) and/or the University Police Department (518-442-3131, <http://police.albany.edu/>).

Please note, faculty members are considered “responsible employees” at the University at Albany, meaning that they are required to report all known relevant details about a complaint of sexual violence to the University’s Title IX Coordinator, including names of anyone involved or present, date, time, and location.

COURSE OUTLINE

The following schedule of lecture topics and reading assignments is preliminary and may be changed as the semester progresses. The final schedule will be provided in Blackboard.

date	topic	paper presenting
8/27	introduction & presentation	
9/3	overview of DMF	
9/10	JPEG basics, JPEG forensics	
9/17	color filter array based forensics	Adversarial CNN Training Under JPEG Laundering Attacks: a Game-Theoretic Approach (paper 55)
9/24	PRNU based forensics	CNN Correlation Predictor for PRNU-based Image Forgery Localization (paper_75)
10/1	noise level based forensics	SPN-CNN: Boosting Sensor-Based Source Camera Attribution With Deep Learning (paper_63)
10/8	vignetting estimation	Distinguishing Computer-Generated Images from Natural Images Using Channel and Pixel Correlation paper_54
10/15	fall break no class (final project mid-term report due)	
10/22	detecting pixel resampling	Video Forgery Detection Using Spatio-Temporal Convolutional Neural Network paper_99
10/29	detecting copy-move	Counter Measures for Keypoint Forensics paper_89
11/5	detection contrast mapping	A Method for Identifying Origin of Digital Images Using a Convolution Neural Network paper_33
11/12	3D face based forensics	Visual Feature Space Analyses of Face Morphing Detectors to Predict Generalization Ability paper_59
11/19	detecting DeepFakes	"DeepFake" Detection in H.264 Video Data Based on Compression Ghost Artifacts paper_71
11/26	GAN image detection	Application of Benford's law to GAN-generated image detection paper_105
12/3	fake audio detection	Detecting and Simulating Artifacts in GAN Fake Images paper_98
12/10	reading day (final project report & code due)	