ICSI 445/660: Digital Image Forensics

Instructor: Prof. Siwei Lyu
Prerequisite: curiosity to learn a new and exciting research field, and good eyes.
Logistics: Thursday 2:405:35p, SLG20

Brief Description: This seminar course aims to provide you a comprehensive overview of the major problems and recent developments in the field of digital image forensics. Development of digital technology allows one to manipulate images in ways that were unimaginable ten years ago. As fraudulent or tampered images can have great financial, legal, political and social impact, there is an urgent need for effective forensic tools to authenticate digital images and detect tampering operations. It is a fascinating field that is experiencing rapid developments.

In this course, we will cover the two most important areas in digital image forensics, i.e., camera identification and manipulation detection. We will discuss relevant aspects of photographing, image processing and human vision, as well as a myriad of interesting research topics. By reading and discussing research articles published in core conferences and journals, you will learn both fundamentals in image processing and manipulation, as well as cutting-edge developments in this field. Student projects of this class in previous semesters have turned into conference and journal publications.

The final grade is composed as following: 30% paper review, 30% paper presentation, 30% final exam, 10% attendance quiz. See later sections for details.

Policy:
- late homework (paper review) turn-in is not permitted. Any homework turned in after the due date and time will not be graded. There is no makeups for late turned in homework or missing quiz due to no show in class.
- attendance: After THREE (3) no shows in class without acceptable explanation, the grade will be automatically reduce to an F.
- incomplete grade: This class will not give any incomplete grade. If the work cannot complete in the current semester, the student can choose to retake this class in the following year.
Overview

Reading, presenting and reviewing research papers are important activities in research, and improving skills of these aspects is an important objective of this course. The resources (see below) provide some extra suggestions on effective presentation and paper review.

1. Reading

While reading the assigned papers, you should keep in mind answers to the questions in the Question list (see below), which guides you for emphases during your presentation and reviews. These questions focus on high-level understanding of the methodology. As you are going to read extensively in graduate study, these provide good practice in effective reading and understanding of scientific and technical papers.

2. Presentations

- Each student will be assigned to at least one paper from the paper list by 02/13 (Schedule will be announced later). After the mandatory round of presentation, further voluntary presentation of different paper is allowed to improve the grade.
- Each presentation will be 40 mins in length, with extra 10 mins for questions (total 50 mins as in a regular research talk).
- The presentation is expected to cover each point in the Question list (see below).
- Grading of presentation is based on understanding of the paper, measured by coverage of each point in the Question list (see below), and clarity of the presentation.
- Implementation of proof of concept type of experiments inspired by a presented paper is strongly encouraged and will get extra credits.
- The presentation slides in PDF format need to be submitted by email to the instructor (slyu@albany.edu) one day before the presentation. Failure to do so will remove 10% from the base grade of your presentation.

3. Reviews

- Homework is in the form of a brief review of the paper that answers ALL question in the Question list (see below). The suggestion is to organize your reviews as answers to each question.
- Each review needs to be submitted before the corresponding paper is discussed on class by email (slyu@albany.edu) to the instructor.
- Grading of each review is based on the understanding of the paper, measured by coverage of each point in the Question list (see below). Missing answers to these questions will reduce the grade of each review.
- Each student is required to complete AT LEAST FIVE (5) reviews over the semester. The final grade on homework will be the average of the BEST FIVE review grades of each student.

4. Presentation and Review Question List

1. A brief summary of what this paper is about. (this requests your own understanding, and a verbal copy from the abstract is not acceptable)
2. What is the problem to be solved with this paper?

3. What is the relevance of this problem, or Why is the problem of interest to digital image forensics?

4. Summarize the major steps of the method of solution described in this paper.

5. For the described method to be effective, what conditions have to be satisfied?

6. If the paper describes previous works solving the same problem, what aspects of the described method are different compared with previous works?

7. In what aspect the described work could be improved.

6. Resources

1. how to give a good presentation:
2. how to write a good review:

7. Final Project Proposal

Around midpoint of the semester, each participant needs to prepare a research project proposal.

The project proposal needs to be submitted as PLAIN TEXT file by email (slyu@albany.edu) by class on 03/27. The project proposal should include the following information (preferably put these points in sections or highlighted bullets):

- the team member (at most two participants can form a team to work on a final project);
- description of the problem to be tackled in your project (or what it is about);
- justification of the problem (or why it is important to solve, or why you want to solve it);
- reference to existing works you rely on (if your project is to reimplement) or previous works to compare (if your project is to find new methods)
- statement of novelty or difference of your method if applicable (note: even if you are to reimplement existing work, you need to specify if there is any difference in your implementation from the original work);
- list potentially applicable methods and tools you are going to use in the project (be as specific as possible, for instance, just say "Python" is not enough, but if you say "numerical python with scipy package and skimage for handling image convolution" would be better);
- list of potential risks (or what can go wrong in your project, this may not be applicable for reimplementation also please do not put scheduling or timing issue here);
- list potential success criteria and milestones
The project proposal is graded by following each of these criteria whenever applicable.

The final project presentation will be on the final class meeting or the reading day (up to scheduling). During the presentation, each team is to give a short presentation (20 mins) on the final project, including demonstrations.

8. Final Project Report

Each team is to submit a final project report by the midnight of reading day weekend (05/11). The final project report should be in the format of PDF and submit by email (slyu@albany.edu).

The report should have the structure of a regular research paper, which includes
1. Title of your project
2. Authorship and co-authorship: name(s) of author(s)
3. Abstract: a short (one paragraph) summary of the project on
   1. problem description
   2. basic solution method
   3. summarizing main results/findings in one-two sentences
4. Main Body of the Report should include the following sections:
   1. Introduction:
      1. description of the problem to be solved, importance and motivation of the problem,
      2. high level description of the solution method,
   5. Related Works:
      1. summarize and refer related previous works in this section. The literature survey should be conducted thoroughly.
   6. Method:
      1. describe the main method in sufficient detail, using equations, algorithms, figures
   7. Experimental results:
      1. describe experimental evaluation results
      2. discuss problems/limitations of your method and come up with an explanation
   8. Discussion:
      1. summarize the overall work
      2. describe potential future followup works if applicable
   9. References: full reference list of all papers cited in the report.

Besides, the report should cover all major points mentioned in your project proposal, with additional results and discussions of the project.

You are also encouraged to give a presentation of your report during other venues such as CCI showcase, NTIR, NTCIR, or NYCWiC. I can provide you more support for these extra efforts.