University at Buffalo
Department of Computer Science and Engineering

CSE 510 - Machine Learning for Edge Based Devices

Spring 2021
TuTh 7:05PM - 8:20PM

Location: Online/Synchronous

TENTATIVE Course Syllabus

Administrative Information:

Instructor:	Dr. David Doermann
Office:	113M Davis Hall
Email:	Prefers to be contact through Piazza
Office Hours:	TBD

Instructor:	Dr. Baochang Zhang
Office:	
Email:	Prefers to be contact through Piazza
Office Hours:	TBD

Teaching Assistants:

Teaching Asst:	
Office Hour Location:	302/TA Area Davis Hall
Email:	
Office Hours:	

Course Information:

- Lectures, Homeworks, Quizzes and Projects during the 14-week semester.

Course Objectives:

- This course is an introduction to those areas of Artificial Intelligence that deal with fundamental issues and techniques of deploying machine learning on the edge computing. The emphasis is on both conventional methods and deep learning for efficient computing. Topics to be covered include convolutional kernels and Gabor filters, advanced and efficient features for localization, efficient feature reduction, efficient learning and classifiers, neural network and deep learning, compressed neural networks, quantized neural networks, deep learning and efficient object detectors, neural architecture search, object tracking and object recognition.

Learning Objectives:

- Know what the main factors to build edge computing systems are and how artificial intelligence technologies affect the efficient computing.
- How to use convolutional filters and Gabor filters for efficient object representation. (Project)
- Know how to extract pixel-level features for localization.

- Know how to calculate efficient feature reduction based on subspace learning.
- Know how to build efficient learning and classifiers. (Project)
- Understand how to build neural network and deep learning, and their difference.
- Know how to compress neural networks based on pruning.
- Know how to quantize neural networks. (Project)
- Know how to build efficient object detectors based on deep learning.
- Understand neural architecture search methods.
- Know how to build object tracking and object recognition system.

Prerequisites:

- Linear algebra, calculus, probability theory and programming (Pytorch or Python)

Textbook/Reference Material:

- Computer vision and Machine Perception by Baochang Zhang (Gruyter 2020)

Course Requirements:

- Class attendance and participation is expected
- You are responsible for ALL materials presented in class and assigned to read
- Quizzes will be given during class time only.
- There will be three projects
- Regular deliverables on the project will be graded during the course

Assignments and Submissions:

- All assignments will be graded out of 100 points and weighted according to the table below
- I will drop your lowest quiz and lowest homework grade.
- All assignments will be turned in via UB Learns
- Quizzes and tests will be given online through the UB Learns system. You must install Respondus to take quizzes and tests.

Grading

Assignment/Assessment	Weight
Homeworks	10%
Quizzes	10%
Projects	40%
MidTerm	20%
Final	20%
Total	**100%**

Important Policies:

- It is entirely your responsibility to follow the policies.
- Please ask the instructor if you have questions.

Late Submission Policy

- Completed homework and project deliverables are to be submitted by their deadline (11:59pm).
- For homework, you will have up to 3 days to receive a grade reduced by 50%. No additional late days allowed
- Projects: You will be allowed a total of 3 days/partial day late submissions throughout the semester.
- For homework, each late day will reduce your grade by 50%, and for projects each late day beyond the 3 allowed will reduce your grade by 50%.
- No individual project/homework will be accepted after 3 days late.

Regrading Policy to Correct Grading Errors

- Assignments, quizzes and exams may be submitted for regrading to correct grading errors.
- Regrade requests are due no later than one (**??**) week after the scores are posted.
- Regrade requests must be clearly written and attached to the assignment.
- When work is submitted for regrade, the entire work may be regraded, **which may result in a lower grade.**
- Work done in pencil may not be considered for regrading.

Exam Policy

- No makeup exams will be given except in **provably extreme circumstances**.
- Notify your instructor 24 hours prior to the exam via e-mail if you are going to miss it. If it is medically impossible for you to give prior notice, please obtain a note from a physician detailing the period (and the reason) you were medically incapable of communicating with the instructor.
- If you miss an exam/quiz because of sickness or similar reasons, visit a physician and obtain a note detailing the period and the reason you were medically incapable of taking the exam/quiz.
- You are responsible for knowing about the exam date. Please plan your travel and other activities accordingly.

Grading Policy

- No "I" (Incomplete) will be given except under provably extreme circumstances.
- There is no grade negotiation at the end of the semester.

Disabilities

- If you have a diagnosed disability (physical, learning, or psychological) that will make it difficult for you to carry out the course work as outlined, or that requires accommodations such as recruiting note-takers, readers, or extended time on exams or assignments, please advise the instructor during the first two weeks of the course so that we may review possible arrangements for reasonable accommodations. In addition, if you have not yet done so, contact the Office of Disability Services.

Academic Honesty and Professional Ethics:

- All work must be your own
  - Do not take the answers, words, ideas or research findings of other people as yours; cite and acknowledge properly, and develop your own ideas.
- No cheating
  - According to departmental policy, any violation of academic integrity will result in a Failing Grade for the course, and termination of departmental financial scholarship.
  - Tools will be used to check similarity. **Similar submissions will result in a Failing Grade for all involved parties.**
- Use of a code from an online repository, e.g. Github, must include a proper and clearly visible attribution in your report.
- Attesting to Academic Integrity Policies
  - Your first assignment will be reading and understanding the University and Department Academic Integrity Policies. You will be asked to sign a statement acknowledging that you understand and will follow these policies.
  - https://engineering.buffalo.edu/computer-science-engineering/information-for-students/policies/academic-integrity.html
- Additional information is also available here:
  - https://grad.buffalo.edu/succeed/current-students/policy-library.html

Tentative Schedule

References in the table are to material you should prepare by reading BEFORE class.

Week	Tuesday Topic	Thursday Topic	HWs	QZs	PRs	EXs
1	Introduction of mobile edge intelligence	Path planning and edge computing for terminal user service				
2	Filtering, Convolution and Gabor filters [1]	Filtering and local pattern features				
3	Pixel-features: Harris corner detector and Scale Invariant Feature Transform (SIFT)	Scene recognition				
4	Speech and Audio Processing, Recognition	Q1				
5	Subspace learning for feature extraction	Sparse representation				
6	Machine learning introduction	Machine learning and mobile gesture recognition				
7	Neural networks	Deep learning and Convolutional neural networks				
8	Gabor convolutional networks	Binary convolutional neural networks				
9	Network pruning	Discussion on cogradient descent and quizzes				
10	Neural architecture search	Deep edge computing including adversarial defennse issue and Discussion				
11	Fast Object detection	Deep object objection, and discussion when combined with binary neural networks				
12	Traditional object tracking 1	Traditional object tracking 2				
13	Correlation filter for object tracking	Deep object tracking and discussion				
14	Presentation	Presentation				

References

[1] D. Zhang, Wai-Kin Kong, J. You, and M. Wong. Online palmprint identification. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 25(9):1041–1050, September 2003. Conference Name: IEEE Transactions on Pattern Analysis and Machine Intelligence.