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CAP6412
Advanced Computer Vision

Lecture 1

Yogesh S Rawat
HEC 241

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CAP6412

- **Instructor**: Dr. Yogesh Singh Rawat
- **Email:** yogesh@crcv.ucf.edu
- **Office**: HEC 241
- **Phone**: 4078236495
- **Time**: Tuesdays and Thursdays 3:00 to 4:15PM
- **Location:** HEC 103
- **Office Hours:** Wednesday and Thursday 2:00 PM to 3:00 PM and by appointment
- **Extra Discussion Session**: Wednesdays 4:30 to 5:30, HEC 356
- **Pre-requisite**: CAP5415
- Course webpage: http://crcv.ucf.edu/courses/CAP6412/Spring2020/

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Email: the best way to contact me

- Put [CAP6412] in subject line
- Summarize message in subject line
- Example:
  - [CAP6412] Meeting request: Thursday (Jan 14) 4:30pm?

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Agenda for today

- Course overview
- Introduction to deep learning

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Course objectives

First objective

- Get familiar with computer vision research
- Understand state-of-the-art methods
- Familiar with computer vision datasets
- Understand evaluation methods and metrics
- Improve critical analysis capabilities

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How to read research papers?

- Ask questions before you start
  - What is the motivation?
  - What is the problem?
  - What is the solution?
  - What experiments are done?
  - How is the solution evaluated?

  - What are the contributions?
  - Future direction?
  - Relation with existing works?

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How to read research papers?

- A one-time reading is not going to work
  - Multiple iterations

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4+ step process

- Step 1:
  - Read the title
  - Scan all the sections
- Outcome
  - It will give you an idea what the paper is about

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4+ step process

- Step 2:
  - Read the abstract
  - Scan all the sections again
  - Look for figures about the method
  - Read the conclusion

- Outcome
  - It will give you an idea about
    - The problem being solved
    - A bit about the approach

4+ step process

- Step 3:
  - Read the abstract again
  - Read the introduction
  - Read the overview of the approach
  - Try to understand the method from the main figure
  - Look for the results which are shown
- Outcome
  - Better understanding of the problem
  - More insights into the solution
  - Evaluation

4+ step process

- Step 4:
  - Read method very carefully
  - You can skip alien words
  - Try to understand as much as you can
  - Go through the evaluation carefully
- Outcome
  - You should have a better understanding of the paper now
- If you didn’t understand some part of the paper
  - Now is the time to look into it

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How to read research papers?

- Howto read research papers by

  Dr. Mubarak Shah:

  http://crcv.ucf.edu/people/faculty/HowToRead.html

- The three-pass approach by

  Dr. Srinivasan Keshav:

  http://ccr.sigcomm.org/online/files/p83-keshavA.pdf

Course objectives

Second objective

- How to review a research paper?

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How to review research papers?

- Strengths of the paper
  - Novelty
  - Technical correctness
  - Clarity
  - Evaluation

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How to review research papers?

- Strengths of the paper
- Weakness of the paper
  - Lack of novelty
  - Technically incorrect
  - Lack of clarity
  - Insufficient evaluation

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How to review research papers?

- Strengths of the paper
- Weakness of the paper
- Justification of your evaluation

- Next steps
  - Future direction
    - Another solution
    - Extend the idea
    - Open problem
    - Apply to other problems

Course objectives

Third objective

- How to present a research paper?

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How to present research papers?

- Make good presentations
- Duration : 30 minutes
- Know your audience
  - Assume no one has read the paper before

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How to present research papers?

- Motivation
- Problem description
- Focus on main contributions
- Proposed solution
- Experiments
- Comparisons with state-of-the-art
- Conclusion

- More discussion on this in one-on-one meetings

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Student Learning Outcomes

- Read and understand a research paper.
- Write a comprehensive review of the paper.
- Present a research paper.
- To come up with own ideas to solve the same problem
  - Which may lead to your first research paper.
- To implement known methods or own novel ideas.

Grading Policy

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- Reports 20%
- Presentation 20%
- Attendance and Discussion 20%
- Projects/Programs 40%
  - (Keras, PyTorch, TensorFlow,..)

- **Late Policy**
  - 0 for late reports
  - Projects/Programs
    - 20% off per day
    - up to 4 days

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GPUs

- UCF HPC
- Linux
- Each student will get an account
- There will be presentation about how to use the system:
  - Wed January 16, 3:00PM, HEC 101-B

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Papers/ Reports

- We will discuss one paper in each class
- You can select the paper you want to present from the list on course webpage or
  - Suggest any other paper you want to present with my approval
- All students will read the assigned paper before the class and write a report
- Reports will be due just before the class meeting through Web Courses
- One student will be responsible for presenting the paper
- Each presentation will be of maximum 30 minutes
- Papers: http://crcv.ucf.edu/courses/CAP6412/Spring2020/
- Schedule Table

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Reports (one page maximum)

- Summary
- Good points
- Weak points
- Questions
- Ideas

- Format: https://www.overleaf.com/read/cbrvnkmnbbyd
- Name: [student id]_[last name].pdf (abcdefgh_rawat.pdf)

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Reports- BONUS

- 20% extra marks if
  - Provide results/insights by running the available code

Paper presentation review/Rehearsal Schedule

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- Review of power point presentation:
- For Thursday presentation
  - Review Monday 2:40PM/HEC 450
  - Rehearsal Tuesday 2:00 PM/HEC 356
- For Tuesday presentation
  - Review Thursday a weak before during office hours: 2:00 PM/HEC 241
  - Rehearsal Monday 2:00PM/HEC 450

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Projects

- Three projects
  - Assignment 1 – A basic CNN implementation
  - Assignment 2 – Implement one of the paper
    - Will be announced later
  - Assignment 3 – Extend the idea from one of the paper
    - Will be announced later

- All project will require
  - Code submission
  - A report submission (CVPR 2020 template: http://cvpr2020.thecvf.com/sites/default/files/2019-09/cvpr2020AuthorKit.zip)

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No final exam

- Only presentations from final project
  - 5 minutes spotlight presentations

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Statement of Academic Integrity

- The UCF Golden Rule (http://goldenrule.sdes.ucf.edu/) will be observed in the class. Plagiarism and Cheating of any kind on an examination, quiz, or assignment will result at least in an "F" for that assignment (and may, depending on the severity of the case, lead to an "F" for the entire course) and may be subject to appropriate referral to the Office of Student Conduct for further action. I will assume for this course that you will adhere to the academic creed of this University and will maintain the highest standards of academic integrity. In other words, don't cheat by giving answers to others or taking them from anyone else. I will also adhere to the highest standards of academic integrity, so please do not ask me to change (or expect me to change) your grade illegitimately or to bend or break rules for one person that will not apply to everyone.

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Course overview

- Topics we will cover:
  - Semi-supervised learning
  - Unsupervised learning
  - Self-supervised learning
  - Adversarial learning
  - Meta learning
  - Capsule networks

- Problems we will study:
  - Activity recognition
  - Image/video synthesis
  - Image/video segmentation
  - Data imbalance
  - Noisy data

Text Book

There is no text book for this class. We will discuss recent research papers.

Recommended supplemental textbook:

- Ian Goodfellow, Yoshua Bengio, Aaron Courville. Deep Learning. (free electronic version)

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UCF Resources

- Tutorial on Keras: Kishan Athrey
- Deep Learning Introduction: Rawat/Shah youtube: UCF CRCV: Deep Learning)
- CAP6412 Spring 2018

Recommended online courses and tutorials

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- https://www.youtube.com/watch?v=CS4cs9xVecg&list=PLkDaE6sCZn6Ec-XTbcX1uRg2_u4xOEky0 Andrew Ng
- http://cs231n.stanford.edu/CS231n: Convolutional Neural Networks for Visual Recognition
- http://web.stanford.edu/class/cs224n/CS224n: Natural Language Processing with Deep Learning
- http://rll.berkeley.edu/deeprlcourse/CS 294: Deep Reinforcement Learning
- http://distill.pub/ Very nice explanations of some DL concepts
- https://class.coursera.org/ml003/lecture/preview
- https://media.nips.cc/Conferences/2016/Slides/6203-Slides.pdf
- https://media.nips.cc/Conferences/2016/Slides/6198-Slides.pdf
- https://adeshpande3.github.io/adeshpande3.github.io/The-9-Deep-Learning-Papers-You-Need-To-Know-About.html
- https://github.com/adeshpande3?tab=repositories

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Deep Learning Has Been Disruptive

- Very Different Paradigm
- Excellent results
- Rapid Progress
- Computer Vision is impacting other areas

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Deep Learning Has Been Disruptive

Dramatic Increase in Number of

- Publications
- Attendance in Conferences
- Datasets
- Startups
- Academics moving to Industry
- Software platforms/libraries
  - Pytorch, Keras, Tensor Flow, Chainer, ..
- GPUs
- Tutorials, videos, online courses

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Computer Vision Conferences and Journals

- Conferences
  - International Conference on Computer Vision (ICCV)
  - Computer Vision and Pattern Recognition (CVPR)
  - European Conference on Computer Vision (ECCV)
- Review process
  - Submission, double-blind review, rebuttal, decision
  - More noisy reviews
  - Publication in about 5-6 months

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Computer Vision Conferences and Journals

- Journals
  - IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI)
  - International Journal of Computer Vision (IJCV)
  - Computer Visio and Image Understanding (CVIU)
- Review
  - Submission, single-blind review, response, review, response,……, decision
  - Less noise
  - Publication in > 1 year

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Machine Learning Conferences

- Neural Information Processing Systems (**NIPS**)
- International Conference on Machine Learning (**ICML**)
- International Conference on Learning Representations (**ICLR**)

NeurIPS 2018 Tickets

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Sold Out in Less Than 12 Minutes



Faster than this year's Burning Man, but still not as fast as a Beyonce concert! Maybe next year.

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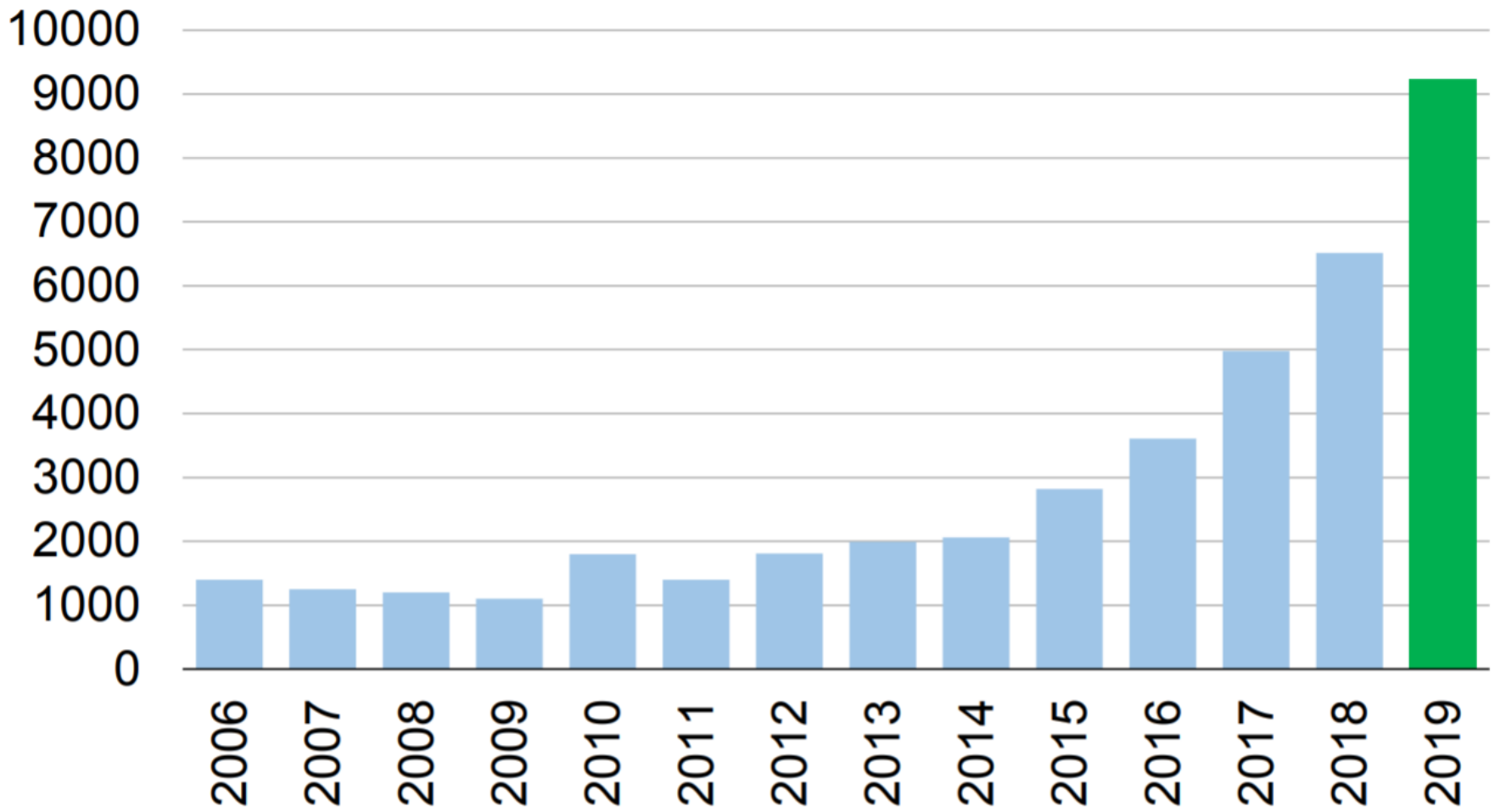
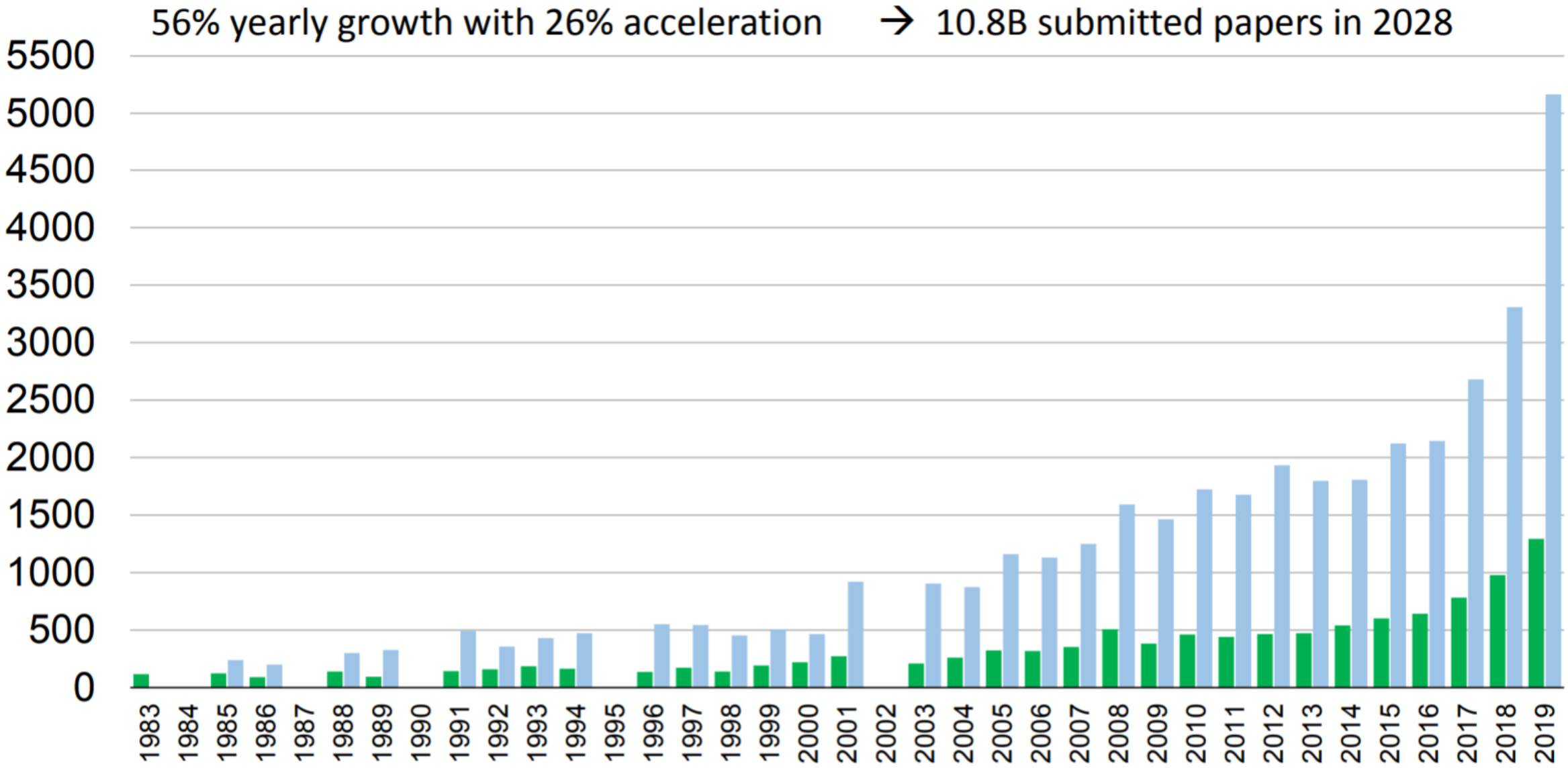
CVPR Attendance Trend



CVPR Submitted and Accepted Papers



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Thank you!
Questions?