Lecture 1
Course Introduction
Outline

• Syllabus
• Course Introduction
  • Machine Learning (ML)
  • Computer Vision (CV)
  • Natural Language Processing (NLP)
• Formal Prerequisites
  • AI 1 (CS 346)
    • not really necessary
  • CS2210
  • First-year course in Calculus
  • Some Linear Algebra

• Grading
  • 3 Short (1 hour) quizzes 18% each
  • Programming assignments (16%, 15%, 15 %)
    • in Matlab and C++
    • I will give a short introduction to Matlab
• Assignments
  • may discuss but **work must be done individually**
  • we use automatic program to check for cheating
    • each year several people detected
      • -assignment score penalty
  • Hand in by the midnight on the due date
    • Submission via OWL
• Late penalty
  • 5% one day late
  • 10% two days late
  • 15% three days late
  • 20% four days late
  • Not accepted after 4 days
  • Sat and Sun count as 1 day
Syllabus

• 3 short easy quizzes
  • 1 hour each
  • open lecture notes
  • calculators OK, but no other electronic devices
• We will not follow this textbook too closely
• You should attend lectures, we will cover a lot of material not in the textbook
• No required, only recommended books
• Useful books:
  • NLP: Manning and Schutze, *Foundations of Statistical Natural Language Processing*
  • CV: R. Szeliski, *Computer Vision: Algorithms and Applications*
Course Intro: What is AI?

• Branch of computer science, which
  • is the science of making machines do things that would require intelligence if done by men (Minsky)
  • is the study of the computations that make it possible to perceive, reason, and act (Winston)
  • is the study of how to do things which at the moment people do better (Rich & Knight)
• “Artificial Intelligence” term was coined in 1956 by John McCarthy at MIT
Course Intro: What is AI?
• AI is an extensive field of Computer Science
• In this course, we offer a brief introduction to three sub-fields of AI
  • Machine Learning
  • Computer Vision
  • Natural Language processing
What is Machine Learning?

- Develop algorithms that allow computers to “learn”
- We will use a narrow definition of “learning”
  - Learn to assign an object or an example to one of the several pre-specified categories (also called a class)
  - “Learning” is also called Pattern Recognition
- Example:
ML Application: Face Detection

- Objects – image patches
- Classes – “face” and “not face”
ML Application: Character Recognition

- Objects – images or image patches
- Classes – digits 0, 1, ..., 9

Digit recognition, AT&T labs
http://www.research.att.com/~yann/

License plate readers
http://en.wikipedia.org/wiki/Automatic_number_plate_recognition

Slide Credit: D. Hoiem
ML: Application: Medical Image Processing

• Objects – pixels
• Classes – different tissue types, stroma, lumen, etc.
ML Application: speech understanding

- Objects – acoustic signals
- Classes – phonemes

re-kig-'ni-sh&n
ML Application: Loan Approvals

- Objects – people
- Classes – “approve”, “deny”

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What is Computer Vision?

• Design computer programs that can see
  • i.e. understand and interpret information in images, video, etc.

• Vision is our primary tool for experiencing the world
  • approximately 50% of cerebral cortex is for vision

• Computer vision is useful for a variety of applications
CV Application: Robot Navigation
Modeling and Rendering Architecture from Photographs
Debevec, Taylor, and Malik 1996
CV Application: Medical Image Segmentation

M. Leventon
CV Application: Digital Libraries

- Data Base extenders for media data management
- Server based
- CBIR
  - IBM QBIC
  - Virage, etc.
- Good for Ad professional
  - Similarity for fade, wipe, etc
- Consumers want
  - “just find it”
  - Natural user interface

Pradeep K. Dubey, pradeep.dubey@intol.com
What is Natural Language Processing?

- Develop computers that can understand human ("natural") language and speak human language
- Computers would be much easier to use with Natural Language Interface
- Can we “teach” them to understand human language?
  - many NLP applications use Machine Learning
Президент США пока не принял решение, следует ли расширить американское военное присутствие в Ираке.

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<td>The President OF THE USA thus far did not accept the solution, should be enlarged American military presence in Iraq.</td>
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А вы, мои друзья последнего призыва!
Чтоб вас оплакивать, мне жизнь сохранена.
Над вашей памятью не стыть плакучей ивой,
А крикнуть на весь мир все ваши имена!
Да что там имена!
Ведь все равно — вы с нами!..
Все на колени, все!
Багряный хлынул свет!
И ленинградцы вновь идут сквозь дым рядами —
Живые с мертвыми: для славы мертвых нет.

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<td>But you, my friends of last call! In order you to mourn, to me life is preserved. Above your memory not to cool by weeping willow, A to shout to entire peace all your names! Yes that there names! Indeed nevertheless - you with us!.. All to the elbows, everything! Crimson gushed out light! And residents of Leningrad again go through the smoke by numbers - living with the corpses: there are no corpses for the glory.</td>
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должно не работать так хорошо для поэзии

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NLP Application: Speech Synthesis

- Text to speech
- http://www.cepstral.com/demos/

"My latest **project** is to learn how to better **project** my voice"

speech

disambiguates parts of speech
Three Bears Story

Once upon a time there were three Bears, who lived together in a house of their own in a wood. One of them was a Little Wee Bear, and one was a Middle-sized Bear, and the other was a Great Big Bear. One day, after they had made the porridge for their breakfast, and poured it into their porridge-bowls, they walked out into the wood while the porridge was cooling, that they might not burn their mouths by beginning too soon, for they were polite, well-brought-up Bears. And while they were away a little girl called Goldilocks, who lived at the other side of the wood and had been sent on an errand by her mother, passed by the house, and looked in at the window. And then she peeped in at the keyhole, for she was not at all a well-brought little girl. Then seeing nobody in the house she lifted the latch. The door was not fastened, because the Bears were good Bears, who did nobody any harm, and never suspected that anybody would harm them. So Goldilocks opened the door and went in; and well pleased was she when she saw the porridge on the table. If she had been a well-brought-up little girl she would have waited till the Bears came home, and then, perhaps, they would have asked her to breakfast; for they were good Bears—a little rough or so, as the manner of Bears is, but for all that very good-natured and hospitable. But she was an impudent, rude little girl, and so she set about helping herself. First she tasted the porridge of the Great Big Bear, and that was too hot for her. Next she tasted the porridge of the Middle-sized Bear, but that was too cold for her. And then she went to the porridge of the Little Wee Bear, and tasted it, and that was neither too hot nor too cold, but just right, and she liked it so well that she ate it all up, every bit! Then Goldilocks, who was tired, for she had been catching butterflies instead of running on her errand, sat down in the chair of the Great Big Bear, that was too hard for her. And then she sat down in the chair of the Middle-sized Bear, and that was too soft for her. But when she sat down in the chair of the Little Wee Bear, that was neither too hard nor too soft, but just right. So she seated herself in it, and there she sate till the bottom of the chair came out, and down she came, plump upon the ground; and that made her very cross, for she was a bad-tempered little girl. Now, being determined to rest, Goldilocks went upstairs into the bedroom in which the Three Bears slept. And first she lay down upon the bed of the Great Big Bear, but that was too high at the head for her. And next she lay down upon the bed of the Middle-sized Bear, and that was too high at the foot. And then she lay down at the head of the bed of the Great Big Bear, and that was too high at the head nor at the foot, but just right. So she covered herself up comfortably, and lay there till she fell fast asleep. By this time the Three Bears thought their porridge would be cool enough for them to eat it properly; so they came home to breakfast. Now careless Goldilocks had left her spoon upon the bed of the Great Big Bear standing in his porridge. "SOMEBODY HAS BEEN AT MY PORRIDGE!" said the Great Big Bear in his great, rough, gruff voice. Then the Middle-sized Bear looked at his porridge and saw the spoon was standing in it too. "SOMEBODY HAS BEEN AT MY PORRIDGE!" said the Middle-sized Bear in his middle-sized voice. Then the Little Wee Bear looked at his porridge, and there was the spoon in the porridge-bowl, but the porridge was all gone! "SOMEBODY HAS BEEN AT MY PORRIDGE, AND HAS EATEN IT ALL UP!" said the Little Wee Bear in his little wee voice. Upon this the Three Bears, seeing that one had entered their house, and eaten up the Little Wee Bear's breakfast, began to look about them. Now the careless Goldilocks had not put the hard cushion straight when she rose from the chair of the Great Big Bear. "SOMEBODY HAS BEEN SITTING IN MY CHAIR!" said the Great Big Bear in his great, rough, gruff voice. And the careless Goldilocks had squatted down the soft cushion of the Middle-sized Bear. "SOMEBODY HAS BEEN SITTING IN MY CHAIR!" said the Middle-sized Bear in his middle-sized voice. "SOMEBODY HAS BEEN SITTING IN MY CHAIR, AND HAS SATE THE BOTTOM THROUGH!" said the Little Wee Bear in his little wee voice. Then the Three Bears thought they had better make further search in case it was a burglar, so they went upstairs into their bedchamber. Now Goldilocks had pulled the pillow of the Great Big Bear out of its place. "SOMEBODY HAS BEEN LYING IN MY BED!" said the Great Big Bear in his great, rough, gruff voice. And Goldilocks had pulled the bolster of the Middle-sized Bear out of its place. "SOMEBODY HAS BEEN LYING IN MY BED!" said the Middle-sized Bear in his middle-sized voice. But when the Little Wee Bear came to look at his bed, there was the bolster in its place! And the pillow was in its place upon the bolster! And upon the pillow—? There was Goldilocks's yellow head—which was not in its place, for she had no business there. "SOMEBODY HAS BEEN LYING IN MY BED, AND HERE SHE IS STILL!" said the Little Wee Bear in his little wee voice. Now Goldilocks had heard in her sleep the great, rough, gruff voice of the Great Big Bear; but she was so fast asleep that it was no more to her than the roaring of wind, or the rumbling of thunder. And she had heard the middle-sized voice of the Middle-sized Bear, but it was only as if she had heard some one speaking in a dream. But when she heard the little wee voice of the Little Wee Bear, it was so sharp, and so shrill, that it awakened her at once. Up she started, and when she saw the Three Bears on one side of the bed, she tumbled herself out at the other, and ran to the window. Now the window was open, because the Bears, like good, tidy Bears, as they were, always opened their bedchamber window when they got up in the morning. So naughty, frightened little Goldilocks jumped; and whether she broke her neck in the fall, or ran into the wood and was lost there, or found her way out of the wood and got whipped for being a bad girl and playing truant, no one can say. But the Three Bears never saw anything more of her.

Summary by “Mead”

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Summary

• Brief introduction to three very active and exciting areas of AI
  • Machine Learning (ML)
  • Natural Language Processing (NLP)
  • Computer Vision (CV)
• Each programming assignment will focus on developing a practical application in each of these areas