

Introduction

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My Introduction

- Name: Dr. Fayyaz ul Amir Afsar Minhas
- Teaching Experience
 - 2007 till now
 - AI, ML, BI, CG, CBD,...
- PhD (Computer Science)
 - Fulbright Scholar
 - Colorado State University, Fort Collins, USA
 - Area of research: Machine learning in Bioinformatics
- MS (System Engineering)
 - PIEAS
 - Area of Research: Biomedical signal analysis and machine learning
- BS (Computer & Information Sciences)
 - PIEAS
 - Area of Research: Biometrics and Image Processing
- Biomedical Informatics Research Lab
 - Focus on developing intelligent algorithms for solving problems in Biology and Medicine



Intelligence

- A very general mental capability that, among other things, involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly and learn from experience. [1]
- Measurement of Intelligence: IQ

[1] Mainstream Science on Intelligence reprinted in Gottfredson (1997). Intelligence p. 13

Knight's Plight



Calculative Puzzle

 The number of times the digit 0 appears in this puzzle is x. The number of times the digit 1 appears in this puzzle is x. The number of times the digit 2 appears in this puzzle is x. The number of times the digit 3 appears in this puzzle is x. The number of times the digit 4 appears in this puzzle is x. The number of times the digit 5 appears in this puzzle is x. The number of times the digit 6 appears in this puzzle is x. The number of times the digit 7 appears in this puzzle is x. The number of times the digit 8 appears in this puzzle is x.



Calculative Puzzle

The number of times the digit 0 appears in this puzzle is 1. The number of times the digit 1 appears in this puzzle is 11. The number of times the digit 2 appears in this puzzle is 2. The number of times the digit 3 appears in this puzzle is 1. The number of times the digit 4 appears in this puzzle is 1. The number of times the digit 5 appears in this puzzle is 1. The number of times the digit 6 appears in this puzzle is 1. The number of times the digit 7 appears in this puzzle is 1. The number of times the digit 8 appears in this puzzle is 1. The number of times the digit 8 appears in this puzzle is 1.



Paintings by two different painters





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CIS 530: Artificial Intelligence

Pigeons as Art Experts

- Pigeons were placed in a box and presented pictures of two different artists (Van Gogh and Chagall)
- They were rewarded for pecking when a particular artist was shown to them
- Pigeons were able to discriminate between Van Gogh and Chagall with 95% accuracy (when presented with pictures they had been trained on)
- Discrimination still 85% successful for previously unseen paintings of the artists

http://en.wikipedia.org/wiki/Discrimination_abilities_of_pigeons







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Find the odd one out!





Some More...

- What is the next number in this series:
 1,1,2,3,5,____
- Would you cross a road when a fast car is approaching?



Conclusions

- Knight's Plight
 - Planning
- Calculative Puzzle
 - Calculation, Computation, Reasoning
- Finding the odd flower
 - Unsupervised Learning
- Pigeons as Art Experts
 - Supervised Learning
- Series Completion
 - Prediction
- Road Crossing
 - Rational Actions
- Process of Writing this Conclusion
 - Summarizing, Abstraction
- These are the very characteristics of Intelligent beings!!

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Searching for a

solution is

central to

intelligence

What is Artificial Intelligence?

- Computers are _____
 - Dumb
- Making a machine (computer) perform the same tasks which you have just done is called

- Artificial Intelligence

- If you learn to do these tasks using existing data, then this is called _____
 - Machine Learning

Artificial Intelligence

- Artificial Intelligence takes the problem of understanding *how we think* a step further
 - It attempts not just to understand it but also to build intelligent entities
- A more proper definition of Artificial Intelligence
 - The art of creating machines that perform functions that require intelligence when performed by people [1]
- Measurement of Artificial Intelligence
 - Turing Test

[1] Rich E., and Knight K., (1991). Artificial Intelligence (2e), McGraw-Hill, NewYork.

Artificial Intelligence

- Turing Test
 - Suggested major components of AI: knowledge, reasoning, language understanding, learning
- Application of the Turing Test
 - CAPTCHA: Completely Automated Public Turing test to tell Computers and Humans Apart [1]



[1] http://en.wikipedia.org/wiki/CAPTCHA

[2] http://en.wikipedia.org/wiki/List_of_Chatterbots

Is AI Intelligent?

Planning

- Kasparov Vs. IBM Blue (1997)
- Time Table Schedulers
- Calculation
 - Symbolic Integration in Mathematica
 - Theorem Provers



Is AI Intelligent?...

- Learning without a Teacher
 - ERDAS Imagine –
 Classification of Land
 Use
 - Associative Memories for data storage in Databases

= wetland;

= water:



= marginal habitats; = upland (non-useable habitats).

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Is AI Intelligent?...

Learning with a teacher

 No Hands Across America!
 Optical Character Recognition





From Computer Desktop Encyclopedia © 1998 The Computer Language Co. Inc





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Is AI Intelligent?...

Prediction

- Sunspot Number Prediction



A Brief History of Al

Dartmouth Conference: The Founding Fathers of AI



John McCarthy



Marvin Minsky

vin Minsky Claude Shannon

Alan Newell

Herbert Simon Arthur Samuel





And three others... Oliver Selfridge (Pandemonium theory) Nathaniel Rochester (IBM, designed 701) Trenchard More

Ray Solomonoff

(Natural Deduction)





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A Brief History of Al...

- 1993 to onwards
 - IBM Deep Blue
 - NOHAA
 - Checkers Solved
 - ASIMO Robots
 - IBM Watson: Beats Humans in Jeopardy
 - Deep Blue vs. Gary Kasparov
 - Wolfram Alpha: Computational Knowledge Engine
 - KINECT
 - The Intelligent Agents Paradigm

Measuring Al

- The broad classes of outcome for an AI test are:
 - optimal: it is not possible to perform better
 - strong super-human: performs better than all humans
 - super-human: performs better than most humans
 - sub-human: performs worse than most humans



Examples



The error rate of AI by year for image classification. Red line - the error rate of a trained human.

Artificial Intelligence as a Career



Basics and Support

Programming

Algorithms, Data structures

Statistics

Linear Algebra

Calculus, Optimization Techniques

High Performance Computing

Software Engineering, Cloud Systems

PIEAS Courses

Core

- Artificial Intelligence
- Pattern Classification & Recognition
- Machine Learning
- Computational Intelligence
- Deep Learning
- Information Retrieval & Datamining
- Evolutionary Techniques
- Neural Networks
- Fuzzy Systems

Applications

- Bioinformatics
- Computational Biomolecular Design
- Image Processing
- Computer Vision
- Computers & Network Security
- Robotics

CIS 530: Artificial Intelligence

What can I do with an AI specialization?

- Academics & Research
- Jobs
 - Bioinformatics
 - Medical Informatics
 - Data Science
 - Vision
 - Security
 - Gaming
- Indirect Effects
 - Algorithms
 - Programming

This Course

- My Assumptions
 - Good programming, data structures & algorithms concepts
 - A passion to learn!
- Objectives
 - Know about the state of the art algorithms and theory in Artificial Intelligence
 - Understand 'agent models' of Artificial Intelligence
 - Be able to apply concepts of Artificial Intelligence in real life development projects
 - 1.5 class hours require 1.5 hours of out-of-class learning
- Requirements
 - Attendance (80%)

This Course

Contents

- W1: Basics and Introduction and Python
- Search Techniques
 - W2: Uninformed Search (BFS, DFS, IDS...)
 - W2: Heuristic Search (A*)
 - W3: Local Search (Hill Climbing, Simulated Annealing, GA)
 - W4: CSPs
- W5: Game Programming (Min-Max, Alpha-Beta Pruning)
- W6: Reinforcement Learning
- W7: Probabilistic Learning (HMM, Bayesian Networks?)

• Evaluation

- 50 % Marks for Final
- 15% Class Project
- 15% Mid
- 15% Assignments
- 5% Quizzes
- Bonus

This Course: Logistics

- Course Webpage
 - Piazza
 - <u>https://piazza.com/pieas.edu.pk/summer2016/cis530/home</u>
 - Please register, signup or send me an email so
 - afsar at pieas dot edu dot pk
 - Please use a single email address for all interaction and be sure to check it daily for updates
- Office Hours
 - (Free Tuition Time!) Tuesdays 1000-1045, B-215
 - By Email Appointment

This Course: Logistics

- Books
 - \\172.30.10.2\FacultyShare\Fayyaz ul Amir Afsar
 Dr\CIS530
- Python Help
 - Faculty Share
 - \\172.30.10.2\FacultyShare\Fayyaz ul Amir Afsar Dr
 - \\172.30.10.2\FacultyShare\Fayyaz ul Amir Afsar Dr\PYTHON
- Online Help
 - Scikit: <u>http://scikit-learn.org/stable/tutorial/basic/tutorial.html</u>
 - Scipy: <u>http://www.scipy-lectures.org/</u>

Tasks for Lecture-1

- Study
 - Artificial Intelligence@ Wikipedia
 - <u>http://en.wikipedia.org/wiki/Artificial_intelligence</u>
 - <u>http://en.wikipedia.org/wiki/History of artificial intelligence</u>
 - <u>http://en.wikipedia.org/wiki/Timeline_of_artificial_intelligence</u>
 - <u>http://en.wikipedia.org/wiki/Portal:Artificial_intelligence</u>
 - Chapter-1 and 2 in AIMA

End of Lecture

We want to make a machine that will be proud of us.

- Danny Hillis