MATAKULIAH KECERDASAN BUATAN (TIF 212)

Teguh Bharata Adji (TBA)
Indriana Hidayah (INH)

RPKPS

(Rencana Program Kegiatan Pembelajaran Semester)

- Deskripsi matakuliah
- Tujuan pembelajaran (*learning goals*)
- Luaran pembelajaran (*learning outcomes*)
- Rencana kegiatan mingguan (*lecture plan*)
- Daftar pustaka (*references*)
- Kontrak perkuliahan

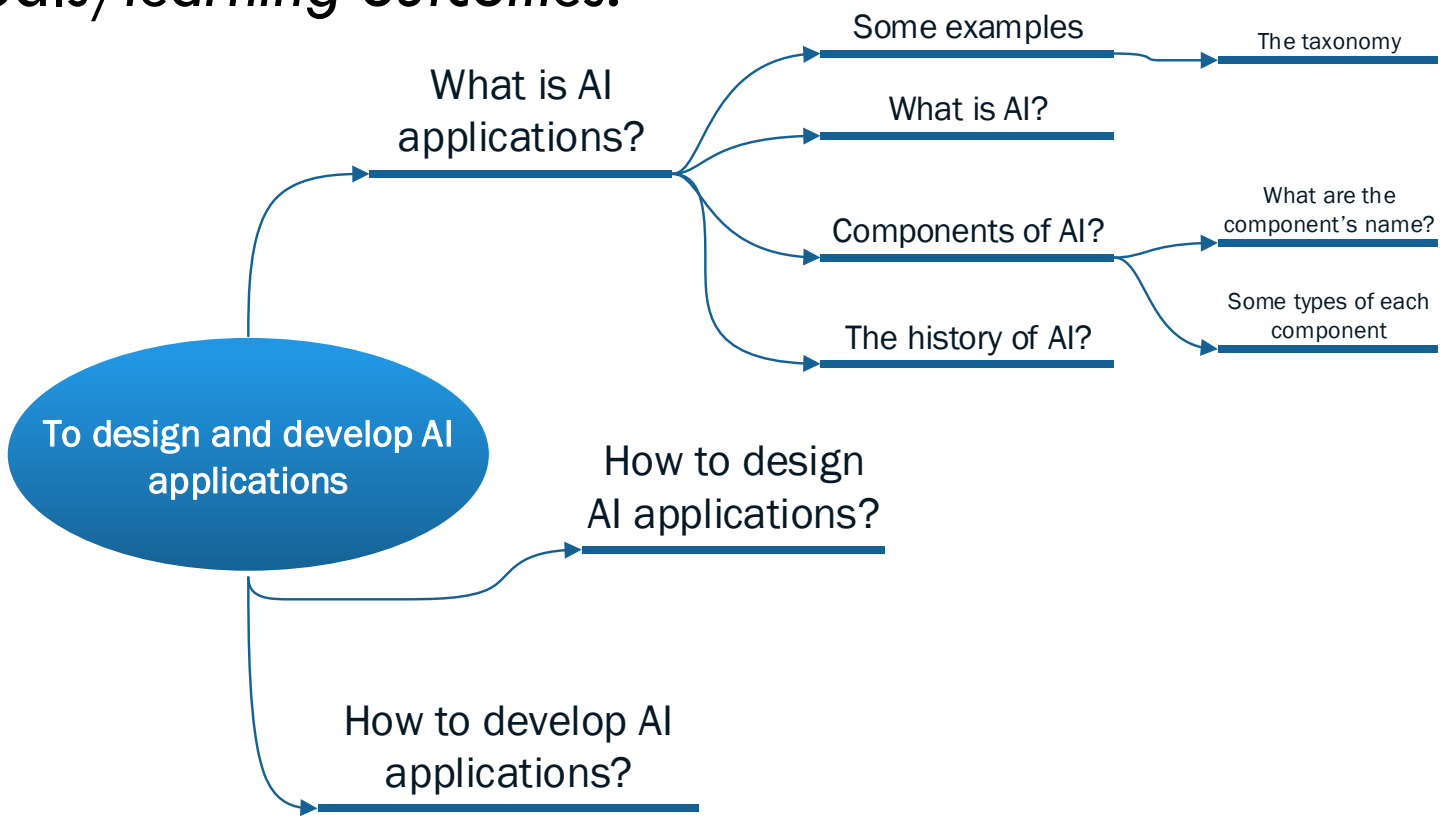
Deskripsi matakuliah

Keminatan	: TI Reguler
Nama Matakuliah	: Kecerdasan Buatan
Kode / SKS	: TIF 212/2 SKS
Prasyarat	: -
Status Matakuliah	: Wajib/~~Pilihan~~

- This course explains how to develop AI applications/systems using AI tools/software.

Tujuan pembelajaran (*learning goals and outcomes*)

- To be able to design and create AI applications.
  - The big goal can be decomposed into smaller sub-goals/*learning outcomes*:

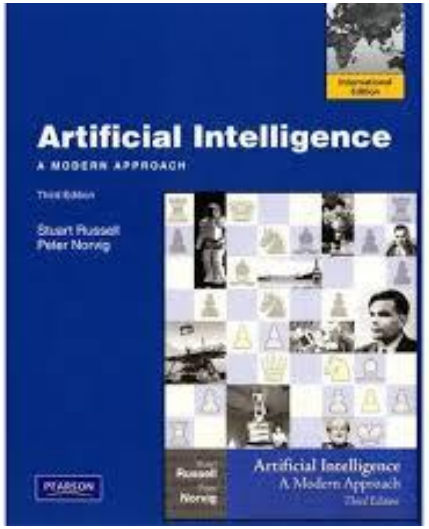


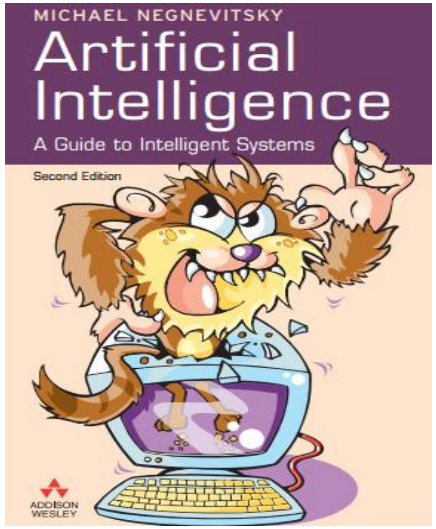
Rencana kegiatan mingguan

1. Introduction to AI
2. Expert systems
3. Knowledge representations
4. Machine learning
5. Search for systematic exploration of alternatives

References

- Russell & Norvig, Artificial Intelligence: A Modern Approach 3rd Ed.
- Negnevitsky, Artificial Intelligence: A Guide to Intelligent Systems 2nd Ed.



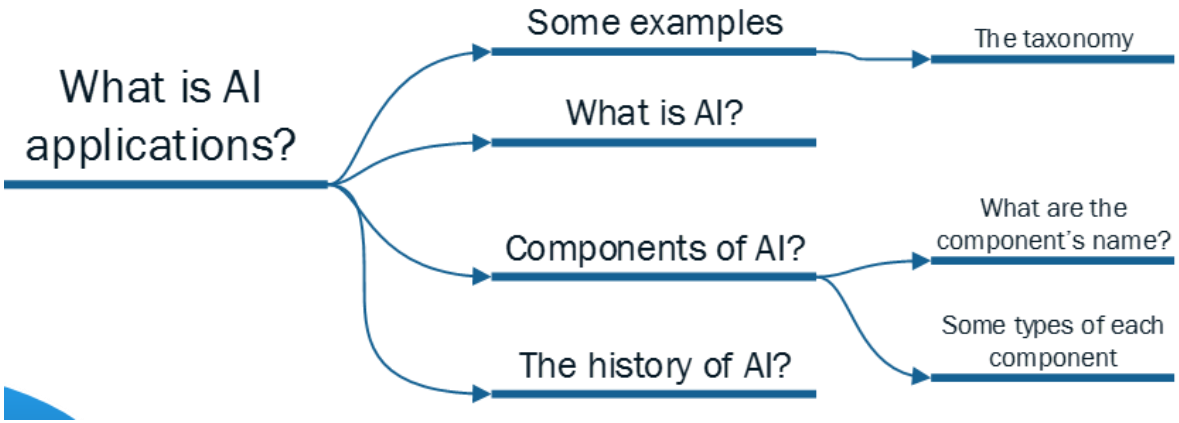


Kontrak perkuliahan

- Unit of assessments
  - Assignments 20%
  - Midterm test 40% → INH
  - Final test 40% → TBA

- Additional rules:
  - Maximum lateness 30 minutes
  - No phones, laptops, tablets, other gadgets during the class

Short-term goals: today's goals



- Describe artificial intelligent
- Taxonomy of AI
- Explain major milestones of AI history
- Some examples of AI applications

KONSEP DASAR KECERDASAN BUATAN

Kecerdasan

Asal kata Kecerdasan atau *intelligence* berasal dari bahasa Latin "intelligo" yang berarti "saya paham". Dasar dari intelligence ialah kemampuan untuk **memahami dan melakukan aksi**.

Kecerdasan adalah istilah yg digunakan untuk menjelaskan sejumlah kemampuan seperti : menalar, memecahkan masalah, berpikir abstrak, belajar, memahami gagasan, menggunakan bahasa

Otak besar bagian kanan merupakan Pusat Kecerdasan Emosi

Otak Besar Kiri merupakan pusat kecerdasan Intelektual (kemampuan berpikir) sebagai pusat nalar, akal, logika

Kecerdasan Manusia

- Manusia memiliki kemampuan untuk menyimpan dan mengeluarkan informasi dalam jumlah yang sangat besar secara efisien yang memungkinkannya:
  - Kreatif : manusia memiliki kemampuan untuk menambah pengetahuan
  - Memungkinkan orang untuk menggunakan pengalaman atau pembelajaran secara langsung
  - Mengemukakan pengetahuan yang dimilikinya
  - Menyelesaikan masalah dan mengambil keputusan
  - Menghubungkan pemikiran dan idenya

Filosofi Kecerdasan Buatan

- Pada saat ini studi tentang kecerdasan manusia tanpa suatu ekspresi formal
- Timbul ide untuk menformalkan kecerdasan dengan membuat mesin atau alat yang cerdas seperti manusia melalui operasi-operasi internalnya.

	Computer	**Human**
Mental Machines	Computer Programs(Software)	Human Mind
Physical Machines	Computer Hardware	Human brain

Pengertian Artificial Intelligence

Some definitions of AI, organized into four categories

Sistem yang berpikir seperti manusia ***Thinking humanly***	Sistem yang berpikir secara rasional ***Thinking rationally***
Sistem yang bertindak seperti manusia ***Acting humanly***	Sistem yang bertindak secara rasional ***Acting rationally***

BERFIKIR SEPERTI MANUSIA: COGNITIVE MODELING

- Diperlukan suatu cara untuk mengetahui bagaimana manusia berfikir
- Diperlukan pemahaman tentang bagaimana pikiran manusia bekerja

Bagaimana Caranya ?

- Melalui introspeksi atau mawasdiri, mencoba menangkap bagaimana pikiran kita berjalan
- Melalui percobaan psikologis.

Acting humanly: The Turing test approach

"The study of how to make computers **do things** at which, at the moment, people are better." (Rich and Knight, 1991)

- Turing test
  - Capabilities needed:
    - Natural Language Processing
    - Knowledge Representation
    - Automated reasoning
    - Machine learning
- Total Turing test
  - Additional capabilities:
    - Computer vision
    - robotics

Stop imitating
Start studying basic principle of intelligence

Berfikir Rasional: the laws of thought

- Cara berfikirnya memenuhi aturan logika yang dibangun oleh Aristotles
  - Pola struktur argumentasi yang selalu memberi konklusi yang benar bila premis benar
  - Menjadi dasar bidang logika
- Tradisi logistik dalam AI adalah membangun program yang menghasilkan solusi berdasarkan logika
- Problem
  - Pengetahuan informal sukar diuraikan dan dinyatakan dalam bentuk notasi logika formal
  - Penyelesaian secara prinsip vs realitas

Bertindak Rasional: rational agent approach

- Bertindak secara rasional artinya bertindak didalam upaya mencapai tujuan (Goal).
- Di dalam lingkungan yang rumit tidaklah mungkin mendapatkan rasionalitas sempurna yang selalu melakukan sesuatu dengan benar

Definisi Artificial Intelligence (AI)

- H. A. Simon (1987) :

  "Kecerdasan buatan (artificial intelligence) merupakan kawasan penelitian, aplikasi dan instruksi yang terkait dengan pemrograman komputer untuk melakukan sesuatu hal yang - dalam pandangan manusia adalah-cerdas"

- Rich and Knight (1991)
- "Kecerdasan Buatan (AI) merupakan sebuah studi tentang bagaimana membuat komputer melakukan hal-hal yang pada saat ini dapat dilakukan lebih baik oleh manusia."

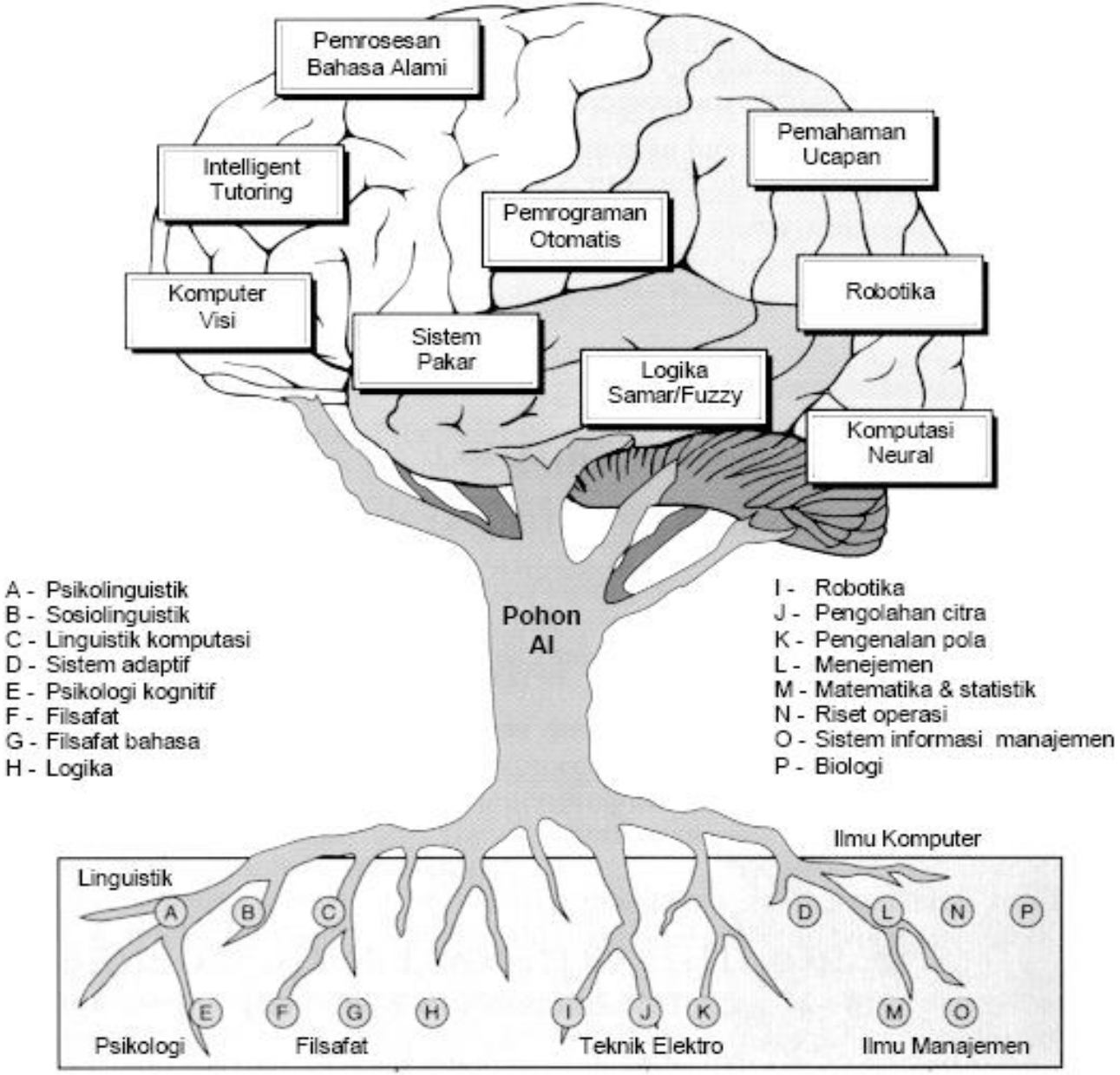
- John McCarthy (1956) :

  “mengetahui dan memodelkan proses –proses berpikir manusia dan mendesain mesin agar dapat menirukan perilaku manusia.”

- Encyclopedia Britannica: :

  “Kecerdasan Buatan (AI) merupakan cabang dari ilmu komputer yang dalam merepresentasi pengetahuan lebih banyak menggunakan bentuk simbol-simbol daripada bilangan, dan memproses informasi berdasarkan metode heuristic atau dengan berdasarkan sejumlah aturan”

Pohon Kecerdasan Buatan dan aplikasi utamanya



Major Branches of AI

- Perceptive system
  - A system that approximates the way a human sees, hears, and feels objects
- Vision system
  - Capture, store, and manipulate visual images and pictures
- Robotics
  - Mechanical and computer devices that perform tedious tasks with high precision
- Expert system
  - Stores knowledge and makes inferences

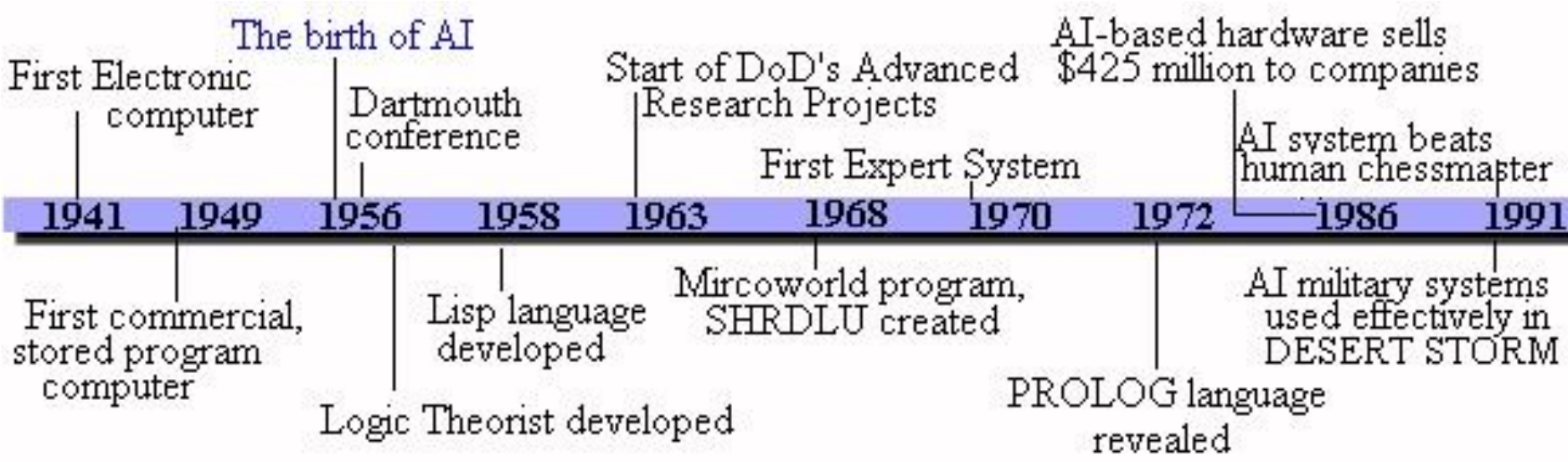
Major Branches of

- Learning system
  - Computer changes how it functions or reacts to situations based on feedback
- Natural language processing
  - Computers understand and react to statements and commands made in a “natural” language, such as English
- Neural network
  - Computer system that can act like or simulate the functioning of the human brain

Academic Disciplines relevant to AI

Philosophy	Logic, methods of reasoning, mind as physical system, foundations of learning, language, rationality.
Mathematics	Formal representation and proof, algorithms, computation, (un)decidability, (in)tractability
Probability/Statistics	modeling uncertainty, learning from data
Economics	utility, decision theory, rational economic agents
Neuroscience	neurons as information processing units.
Psychology/ Cognitive Science	how do people behave, perceive, process cognitive information, represent knowledge.
Computer engineering	building fast computers
Control theory	design systems that maximize an objective function over time
Linguistics	knowledge representation, grammars

Sejarah Kecerdasan Buatan



Sejarah perkembangan Kecerdasan Buatan (1)

Gestation of AI

- 1206-1769 -- Robot humanoid pertama karya Al-Jazari dan Boneka penuang teh dari jepang bernama Karakuri
- 1941 Komputer elektronik pertama
- 1943 McMulloh dan Pitts mengusulkan model matematis bernama perceptron dari neuron di dalam otak. Bagaimana neuron menjadi aktif seperti saklar on-off dan neuron tersebut mampu untuk belajar dan memberikan aksi berbeda terhadap waktu dari input yang diberikan.
- 1949 Komputer dengan program tersimpan pertama

Sejarah perkembangan Kecerdasan Buatan (2)

The birth of AI (1956)

- 1956 John McCarthy dari Massacuhetts Institute of Technology dianggap sebagai **bapak Kecerdasan Buatan,** menyelenggarakan konferensi "The Dartmouth summer research project on artificial intelligence." Disebut sebagai Kelahiran dari Artificial Intelligence

Sejarah perkembangan Kecerdasan Buatan (3)

Early enthusiasm, great expectations (1952-1969)

- 1958 Bahasa LISP dibuat untuk memproses List dengan memanipulasi symbol
- 1959, Nathaniel Rochester dari IBM menghasilkan geometry Theorm Prover. Program ini dapat membuktikan suatu teorema menggunakan axioma-axioma yang ada.
- 1963, program yang dibuat James Slagle mampu menyelesaikan masalah integral untuk mata kuliah kalkulus.
- 1968 program analogi buatan Tom Evan menyelesaikan masalah analogi geometris yang ada pada tes IQ.

Sejarah perkembangan Kecerdasan Buatan (4)

Knowledge-based systems (1969-1979)

- 1969 The Dendral program- recognizing that a molecule contains a particular substructure.
- Expert system- try to apply the concept of Dendral to other areas, such as medical diagnosis (MYCIN)

Sejarah perkembangan Kecerdasan Buatan (5)

AI becomes an industry (1980-present)

- 1982 The first successful commercial expert system- R1- help configure orders for new computer systems
- 1988 Many examples: expert systems, vision systems, robots.

The return of neural network (1986-present)

- Mid 1980s reinvention of back-propagation learning algorithm

Sejarah perkembangan Kecerdasan Buatan (6)

AI adopts scientific methods (1987-present)

- Previously, AI research have yielded new methods. This led to separation of AI from the rest of computer science.
- The use of
  - Data mining
  - Bayesian network
  - Etc.

Sejarah perkembangan Kecerdasan Buatan (7)

Emergence of intelligent agents (1995-present)

- Most important environment for intelligent agents is the Internet.
  - The "-bot" suffix has entered everyday language
  - Al technologies underlie many Internet tools, such as search engines, recommender systems, and Web site aggregators.

Sejarah perkembangan Kecerdasan Buatan (8)

The State of The Art: What can AI do today?

- Robotic vehicles
- Speech recognition
- Autonomous planning and scheduling
- Game playing
- Span fighting
- Logistics planning
- Robotics
- Machine translation

The main topics in AI

Artificial intelligence can be considered under a number of headings:

- Representing Knowledge and Reasoning with it.
- Search (includes Game Playing)
- Planning
- Learning
- Interacting with the Environment

Knowledge Representation & Reasoning

- If we are going to act rationally in our environment, then we must have some way of describing that environment and drawing inferences from that representation.
  - how do we describe what we know about the world ?
  - how do we describe it *concisely* ?
  - how do we describe it so that we can get hold of the right piece of knowledge when we need it ?
  - how do we generate new pieces of knowledge ?
  - how do we deal with *uncertain* knowledge ?

Search

- *Search* is the fundamental technique of AI.
  - Possible answers, decisions or courses of action are structured into an abstract space, which we then search.
- Search is either "blind" or “uninformed":
  - blind
    - we move through the space without worrying about what is coming next, but recognising the answer if we see it
  - informed
    - we guess what is ahead, and use that information to decide where to look next.
- We may want to search for the first answer that satisfies our goal, or we may want to keep searching until we find the best answer.

Planning

Given a set of goals, construct a sequence of actions that achieves those goals:

- often very large search space
- but most parts of the world are independent of most other parts
- often start with goals and connect them to actions
- no necessary connection between order of planning and order of execution
- what happens if the world changes as we execute the plan and/or our actions don't produce the expected results?

Learning

- If a system is going to act truly appropriately, then it must be able to change its actions in the light of experience:
  - how do we generate new facts from old ?
  - how do we generate new concepts ?
  - how do we learn to distinguish different situations in new environments ?

Interacting with the Environment

- In order to enable intelligent behaviour, we will have to interact with our environment.
- Properly intelligent systems may be expected to:
  - accept sensory input
    - vision, sound, …
  - interact with humans
    - understand language, recognise speech, generate text, speech and graphics, …
  - modify the environment
    - robotics

Assignment

- Every year the Loebner Prize is awarded to the program that comes closest to passing a version of Turing Test. Research and report the latest winner of the Loebner Prize. What techniques does it use? How does it advance the state of the art in AI.
  - Do not plagiarize!
  - Written in IEEE paper format.
- To be submitted:
  - Next week meeting (in the beginning of the class)
  - Prepare for sharing your result in front of class.