Overview of Intelligence Amplification

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Abstract: *Intelligence amplification (I.A.) is a multidisciplinary field whose goal is to automate activities that presently require human intelligence. Recent successes in A.I. include computerized medical diagnosticians and systems that automatically customize hardware to particular user requirement. Perception is concerned with building model of the physical world from sensory input (visual, audio, etc.). Many important technical concepts have arisen from A.I. that unify these diverse problem areas and that from the foundation of the scientific discipline.*

Keywords: *Machine learning, Deep learning, Big data, Emotions Recognition.*

I. Introduction

Intelligence amplification (IA) refers to the effective use of Information technology in augmenting human intelligence. The idea was first proposed in the 1950s and 1960s by cybernetics and early computer pioneers. The ability to learn from experience and apply in future action is called intelligence, and when we impart this intelligence into a machine is known as Intelligence amplification. IA is sometimes contrasted with AI (artificial intelligence), that is, the project of building a human - like Intelligence in the form of an autonomous technological system such as a Computer or Robot. AI has encountered many fundamental obstacles, practical as well as theoretical, which for AI seem moot, as it needs technology merely as an extra support for an autonomous intelligence that has already proven to function.

 "I think it's likely that with technology we can in the fairly near future create or become creature of more than human intelligence. Such a technological singularity would revolutionize our world".

II. Key Terms Of Intelligence Amplification

The terms "intelligence augmentation" and "intelligence amplification" evoke images of human beings with computer chips embedded in their skulls or bizarre accoutrements attached to their heads.

* IA does not need to understand the human brain except for extreme enhancement. It can be a user interface issue.
* Gradual acclimatisation
* Effective intelligence might be more relevant than "real" intelligence

Figure: 1 Intelligence Amplification

III. Technolgogy

Intelligence Amplification uses variety of technology to build best:

> **Natural language Generation (NLG)**

NLG is a sub-discipline of Intelligence Amplification (IA) that convert all types of data into human-readable text. This software converts data into text at a rapid pace, enabling machines to communicate effectively.

> **Speech recognition**

Siri is just one of the systems that can understand you. Every day, more and more systems are created that can transcribe human language, reaching hundreds of thousands through voice-response interactive systems and mobile apps.

> **Virtual Agents**

A virtual agent is nothing more than a computer agent or program capable of interacting with humans.

> **IA-Optimized Hardware**

IA technology makes hardware much friendlier. How? Through new graphics and central processing units and processing devices specifically designed and structured to execute IA-oriented tasks.

> **Deep Learning Platforms**

Deep learning platforms use a unique form of ML that involves artificial neural circuits with various abstraction layers that can mimic the human brain, processing data and creating patterns for decision making.

> **Emotion Recognition**

This technology allows software to "read" the emotions on a human face using advanced image processing or audio data processing. We are now at the point where we can capture "micro-expressions," or subtle body language cues, and vocal intonation that betrays a person's feelings.

Figure: 2 Day after Tomorrow

IV. Application

IA is important because it can help solve immensely difficult issues in various industries, such as entertainment, education, health, commerce, transport and utilities. IA applications can be grouped into four categories:

- **Reasoning:** The ability to solve problems through logical deduction. E.g. financial assets management, legal assessment, financial application processing, autonomous weapons system, games
- **Knowledge:** The ability to present knowledge about the world. E.g. purchase prediction, fraud prevention, drug creation
- **Communication:** The ability to understand spoken and written language. E.g. real-time translation of spoken and written languages, real-time transcription, intelligent assistants, voice control
- **Perception:** The ability to infer things about the world via sounds, image, and other sensory inputs. E.g. medical diagnosis, autonomous vehicles, surveillance

IA trends in various sectors:

I.   Healthcare
- ❖ Medecision developed an algorithm that detects 8 variables in diabetes patients to determine if hospitalization is required.
- ❖ An app called BiliScreen utilizes a smartphone camera, ML tools, and computer vision algorithms to detect increased levels of bilirubin in the patient's eye.

II. Automotive industry

❖ Tesla introduced TeslaBot, an intelligent virtual assistant integrated with Tesla models S and X, allows users to interact with their car from their phone or desktop.
❖ Uber AI Labs is working on developing self-driven cars. Uber has already tested a batch of self-driving cars in 2016.
❖ Nvidia has partnered with Volkswagen to develop "intelligent co-pilot systems" in cars that will enable safety warnings, gesture control, and voice and facial recognition.
❖ Ericsson predicts that 5G technology will improve vehicle-to-vehicle communication wherein sensors will be implanted in airport runways, railways, and roads.

V. Algorithms

Intelligence Amplification is the study of building agents that act rationally. Most of the time, these agents perform some kind of search algorithm in the background in order to achieve their tasks. There are far too many powerful search algorithms out there to fit in a single article. Instead, this article will discuss six of the fundamental search algorithms, divided into two categories, as shown below.
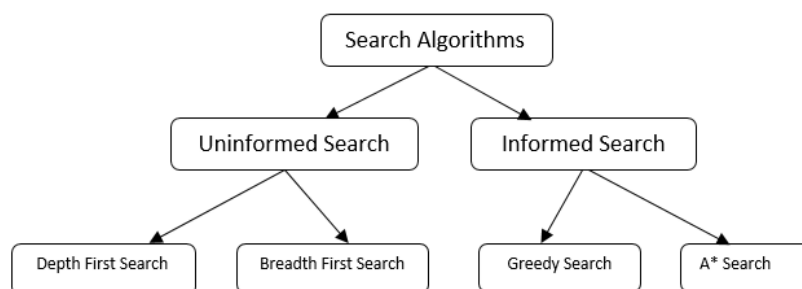

Figure 3: Classification of search algorithm

✓ **Uninformed Search Algorithms**
The plans to reach the goal state from the start state differ only by the order and/or length of actions. Uninformed search is also called Blind search.

Depth First Search
Depth-first search (DFS) is an algorithm for traversing or searching tree or graph data structures. The algorithm starts at the root node (selecting some arbitrary node as the root node in the case of a graph) and explores as far as possible along each branch before backtracking.

Breadth First Search
Breadth-first search (BFS) is an algorithm for traversing or searching tree or graph data structures. It starts at the tree root (or some arbitrary node of a graph, sometimes referred to as a 'search key'), and explores all of the neighbour nodes at the present depth prior to moving on to the nodes at the next depth level.

✓ **Informed Search Algorithms**
The algorithms have information on the goal state, which helps in more efficient searching.

Greedy Search
In greedy search, we expand the node closest to the goal node. The "closeness" is estimated by a heuristic $h(x)$.
Heuristic: A heuristic h is defined as- $h(x)$ = Estimate of distance of node x from the goal node. Lower the value of $h(x)$, closer is the node from the goal.

A* Tree Search
A* Tree Search, or simply known as A* Search, combines the strengths of uniform-cost search and greedy search.

VI. Advantages

- IA would have a low error rate compared to humans, if coded properly. They would have incredible precision, accuracy, and speed
- Replace humans in repetitive, tedious tasks and in many laborious places of work
- Robotic pets can interact with humans. Can help in depression and inactivity
- They don't need to sleep, rest, take breaks, or get entertained, as they don't get bored or tired

VII. Disadvantags

- Can cost a lot of money and time to build, rebuild, and repair. Robotic repair can occur to reduce time and humans needing to fix it, but that'll cost more money and resources
- IA as robots can supercede humans, enslaving us
- As seen partially with smartphones and other technology already, humans can become too dependent on AI and lose their mental capacities
- Machines can easily lead to destruction, if put in the wrong hands. That is, at least a fear of many humans

VIII. Conclusion

The goal of Intelligence amplification is to deliver a symbolic between man and machine. Large amount of data can sometimes solve problems that sophisticated tools cannot. There is significance resistance to the entry of computers to new lines of work, such as medicine, but the next generation will not know of a world without computers.

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