International Journal of Embedded and Wireless Communication Systems
Volume1, Issue 4 2025

Analysis and modelling of strong-AI to engineer BIONIC brain for humanoid robotics application

Kai Zhou[1], and Wei Lu[2]

Electronics and Information Engineering, Sichuan University, Chengdu, Sichuan 610064, China

Research Article

Date of Submission: 11-07-2025 **Date of Acceptance: 10-09-2025** **Date of Publication: 20-11-2025**

Abstract: I started my research by reading literature reviews, the history of AI and robotics from a variety of secondary data and information sources, including white papers, short essays, research papers, research review papers, newspapers, monographs, and standard reference books in the fields of AI, robotics, and humanoid robotics. As my contribution to this field, I gathered, refined, and refined data until it became information. Then, I further filtered the information to turn it into intelligence so that I could create the most advanced Humanoid Robotics engineering models using the research I conducted for this paper.

Keywords: Artificial Intelligence, Thinking Machine, Strong-A.I, Robotics Engineering, Humanoid Robotics, Neurosciences, Neural Network, Artificial Neural Network (ANN)

1. Artificial Intelligence

Despite being one of the newest areas of study, artificial intelligence has roots that date back thousands of years. Understanding the history of many other disciplines—most notably philosophy, linguistics, psychology, and biology—is helpful when researching artificial intelligence. Maybe asking, "What is intelligence?" would be a better place to start. For ages, biologists, psychologists, and philosophers have been perplexed by this difficult subject with no clear solution. The characteristics of intelligence, such as the capacity to adapt to novel circumstances, solve issues, respond to inquiries, make plans, and so on, may undoubtedly be used to characterize intelligence. The distinction between human intellect and that of dolphins or apes may be more difficult to establish. For the time being, we shall limit our discussion to the rather more straightforward query: What Is Artificial Intelligence? The following might be a basic definition:

The study of systems that behave in a manner that would seem intelligent to any observer is known as artificial intelligence.

Although this definition is acceptable, artificial intelligence is not fully covered by it. Artificial intelligence approaches are often used to tackle relatively basic issues or complicated problems that are intrinsic to larger

intricate systems. For instance, search methods are often used to much more mundane tasks, but they are seldom employed to provide a robot the capacity to navigate a labyrinth. This might result in the following alternative definition of artificial intelligence:

Artificial intelligence is the use of techniques to solve complicated problems that are based on the intelligent behavior of humans and other animals.

Certain systems are capable of "understanding" human speech, or at the very least, deriving some meaning from human speech and acting upon it. These systems could just be intended to serve a practical purpose rather than to act intelligently. However, the techniques they use are based on human intelligence. When we examine the differences between so-called strong AI and weak AI, this disparity becomes even more apparent. Strong AI proponents contend that a computer program may be made to actually think and be aware in the same manner as a human being by giving it enough processing capacity and intelligence. This viewpoint is deemed erroneous and even absurd by a large number of philosophers and artificial intelligence experts. The potential to build a robot with feelings and true awareness is one that is often

studied in science fiction, but it is seldom thought about as an artificial intelligence objective. On the other hand, weak AI is only the idea that computers can model and exploit intelligent behavior to solve complicated issues. According to this perspective, a computer's intelligent behavior does not necessarily indicate that it is as intelligent as a person.

1.1. Strong Methods and Weak Methods

The distinction between the assertions of weak AI and strong AI has been covered. The distinction between strong and weak approaches should not be confused with this one. Systems like logic, automated reasoning, and other broad frameworks that may be applied to a variety of issues but do not always integrate any meaningful knowledge about the reality of the problem being handled are examples of weak artificial intelligence techniques. Strong method problem resolution, on the other hand, relies on providing a system with a wealth of information about its environment and potential issues. Because a system with information is meaningless without a technique to handle that knowledge, strong method issue resolution relies on weak methods. Weak techniques were the main focus of early artificial intelligence research. The broad Problem Solver (GPS), developed by Newell and Simon, was an effort to create a system that could handle a variety of broad problems using weak techniques. The eventual failure of this strategy led to the understanding that knowledge was the essential component required for Artificial Intelligence to function, rather than just basic representations and algorithms. Weak approaches are often the best way to solve issues. Strong techniques are undoubtedly necessary if our goal is to create systems that look to act intelligently, but adding knowledge is nearly always necessary to design systems that can deal intelligently with new issues.

1.2. AI and Humanoid

The mechanics of the brain and how it learns, grows, and acquires intelligence from a feeling of consciousness are being examined by scientists much more carefully (Aleksander, 2002). For instance, AI software developers are starting to collaborate with cognitive psychologists and use notions from cognitive science. Another example focuses on the work of "connectionists," who highlight computer architecture and contend that most symbolic AI algorithms are inherently unable to demonstrate the core traits of intelligence to any meaningful extent. Conversely, connectionists want to create artificial intelligence using artificial neural networks (ANNs). Based on the structure of the nervous system, these ‘computational-cognitive models’ are designed to exhibit some form of learning and ‘common-sense’ by drawing links between meanings (Hsiung, 2002). ANNs,then, work in a similar fashion to the brain:as information comes in, connections among processing nodes are either strengthened (if the new evidence is consistent) or weakened (if the link seems false) (Khan, 2002).An underlying paradigm shift in the AI research community is reflected in the advent of ANNs, and as a consequence, these systems have unquestionably attracted a lot of attention lately. However, regardless of their success in creating interest, the fact remains that ANNs have not nearly been able to replace symbolic AI. As Grosz and Davis (1994) remark: ‘[Symbolic AI has] produced the technology that underlies the few thousand knowledge-based expert systems used in industry today.’ A major challenge for the next decade, then, is to significantly extend this foundation to make possible new kinds of high-impact application systems. A second major challenge will be to ensure thatAI continues to integrate with related areas of computing research and other fields(Doyle and Dean, 1996). For example, the kinds of developments described in Section 2for nanotechnology may go some way to accelerating progress in AI, particularly through the sensor interface. For these reasons, the list of main research areas that follows should be regarded as neither exhaustive nor clear- cut. Indeed, future categorizations will again change as the field solves problems and identifies new ones.

1.3. Learning

The University of Washington's Daniel Weld (1995) states that machine learning tackles two interconnected issues: "the development of software that improves automatically through experience and the extraction of rules from a large volume of specific data." These kinds of systems are crucial because they can operate at higher levels than those that need to be manually adjusted to handle circumstances that their creators did not foresee (Grosz and Davis, 1994). As a result, software can automatically adjust to new or evolving users and runtime settings, as well as the ever-growing amounts of various data that are now accessible. AI researchers have a range of learning techniques at their disposal when creating programmers to address these issues. But as previously said, ANNs are among the most promising of them.

1.4. Artificial Neural Networks

ANNs have several benefits, and developments in this area will make them more well-liked. Their primary advantage over symbolical systems is that they are taught rather than coded, which allows them to adapt to their surroundings without the care and attention of their developer (Hsuing, 2002). The capacity of ANNs to categorize and identify patterns as well as manage anomalous input data—a feature crucial for systems handling a variety of data—is another of its main advantages. Additionally, a lot of neural networks are physiologically realistic, which implies that as they develop, they could provide hints about how the brain functions. The capacity of ANNs to process information in parallel—that is, to analyze many pieces of data at once—is what gives them their power, much like the brain. Unfortunately, modern computers are serial and can only carry out one instruction at a time, which is where the limits of such systems start to show. Because of this, simulating parallel processing on serial equipment might take a long time (Matthews, 2000a).A second issue is that it is exceedingly challenging to comprehend their internal thought processes and, therefore, to find an explanation for any given result. They are thus most useful when a model's output is more crucial than comprehending how the model operates. In order to do this, these systems

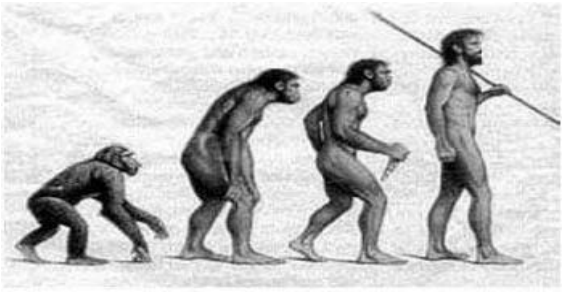
are often used in scientific data analysis, stock market analysis, fingerprint identification, character recognition, and voice recognition (StottlerHenke, 2002).Humanoid Robotics

Once people understand that machine ethics has to do with how intelligent machines, rather than human beings, should behave, they often maintain that Isaac Asimov has already given us an ideal set of rules for such machines. They have in mind Asimov's ''three laws of robotics'':

1. A robot may not injure a human being, or, through inaction, allow a human being to come to harm.
2. A robot must obey the orders given it by human beings except where such orders would conflict with the first law.
3. A robot must protect its own existence as long as such protection does not conflict with the first or second law.

On other side Such man describes how the upcoming of "intelligent" objects changes our attitude towards artifacts from passive things to intelligent others. Properties that we would refer to as typically human like emotion, speech and purposeful action, now (at least partially) apply to computers as well. As a consequence, dealing with artifacts becomes a social activity and can be regarded similarly to human interaction. In cognitive science, computers are used to explore human cognition without being restricted to the (scientifically) observable behavior, but with scientific methods. Its basic assumptions are that Mind is an abstract (bodiless) structure that can be implemented in any kind of physical substrate, like a computer, and that people "act on the basis of symbolic representations", that lead to mental states and provide a consistent behavior, And as a consequence, that cognition can literally be seen as, and therefore simulated by, computation.

Human Evolution vs. Humanoid Evolution





2. Analysis and Designing (Modeling)

In my research very first I will go through the literature surveys, history of AI and Robotics from various secondary data and information sources like white papers, short essays, research papers, research review papers, news papers, monographs and standard reference books in the field of AI, robotics and humanoid robotics. I will collect and refine data and re-refine until data changed to information, where I will further filter information to convert in intelligence to develop most sophisticated Humanoid Robots engineering models.

2.1. Basic Humanoid Robot Engineering Model

This is the very first and fresh model about basic humanoid Robot engineering developed on the basis of several gathered facts and strong research analysis in this domain. In this model I proposed four essential parameters to engineered advanced and humanoid machine and named them BODY, SOUL, INTELLIGENCE and ENERGY. You can clearly get understand why I chooses to these four parameters with human being example. We people are very civilized and living organism on earth but why and the answer is because we have physical human BODY in which we have SOUL installed by God and Brain which is biological thinking machine in short INTELLIGENCE but time to time we people need food to reenergizes ourselves with consuming Vegetables, fruits, grains etc. to generate ENERGY within the BODY to execute for whole day. Similarly when you start to thinking about HUMANOID Robotics designing, you also need to consider same criteria being engineering of Human-like artificial machine. I used to terminology BODY in my model with the intension All electronic devices, sensors, actuators, ICs, processors, controllers required in assembly of Humanoid Artificial Body in Short Hardware part required in construction of dead Humanoid body. This body consist on sensor/transducer in Human-like cognitions (vision, touch, smell, speech/voice recognition), Actuator, motors, servo- motors, electro-Mechanical, Pneumatic parts ,valves etc. for Human-like movement, Advanced logic processors/controller based on "Neural Schemas" and function like Artificial brain ,Memories and Mass storage for Human-like data saving , retrieval , processing ,decision-making, information generation and STM)Short Term Memory) and LTM (Long Term Memory) Schema's , Biological signal conversional, synthesis , for memorization.

recognition and processing schema's and Human-Robots

Second important aspect during Humanoid engineering process is SOUL to make electronic (Hardware) dead body (IN/OUT) Interaction/interfacing Schema's respectively. The basic intension to produce that model is to aware about alive could be possible by engineering Advanced Operating the fact of intellectuality requirement in humanoid

engineered strong-AI for Humanoid Robotics. We much aware about Robotics Hardware i.e. L1 layer hence I skip it and start to processed from layer L2 i.e. A-I Neural Schema's these are ultra-strong A-I programs or set of program to copy human – like processed since Turning
programs/modules/software's, Neural
Networks, Neural
Machine to till the date. Theseschemas are sophisticated
Schema's for strong –AI,Genetic algorithms, Advanced logic engineering for pattern /object recognition and translation (Natural Language Processing), readings, facial expression, love and desire and human like response smart programs. The last strong consideration for Humanoid engineering is ENERGY and energy management i.e. how could we able to engineered reliable ,durable ,cost-effective compact ,dense inbuilt energy strong in Humanoid Robots
and engineered logic for human like Thinking, speech Synthesis and recognition, pattern/image processing (machine vision), precise angular movements, feelings, facial expression, emotions, love, smartness, self -learning, decision-making and so on. But to send data/information up to these schema's layer L3 play very vital role i.e. 'Biological signal conversions, recognitions and processing schema's ' these schema's convert ,identify and process in
and off course possible using ultra low
power consumption
Humanoid human voice , image/faces, touch smell, text and
CMOS rechargeable batteries and units , highly dense and compact energy strong cells , and possibly Renewable and
likewise things, but again to accept all these in electronic
data formats from physical
and Natural human formats

2.2. Layers Diagram of Humanoid Robotics

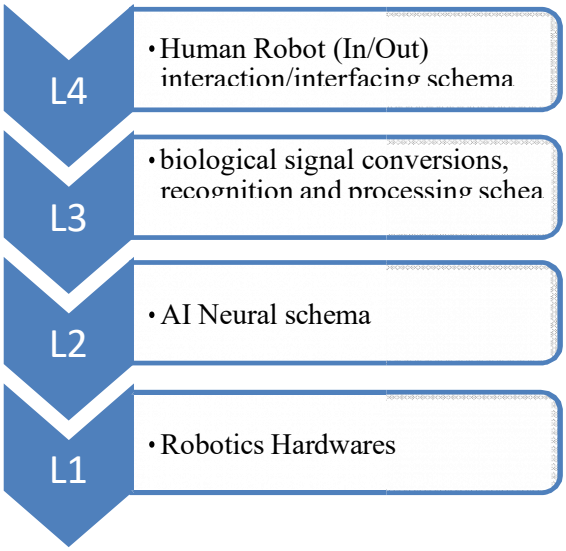


Fig 1: *Layer Diagram of Humanoid Robotics (Source: Prof. Md. Sadique*

GUI/HCI schema's which accept human input from sensor and transducers and software schema's .These three important layers may engineered as individual schema's or integrated schema's.

2.3. Intelligence System Designing Model (ISDM)

This is third important model modeling based on my research finding in Humanoid. I named this model as 'Intelligence System Designing Model (ISDM)', Name itself suggest this model developed with the intension to give knowledge about for

Intelligence System Designing & Development. If we consider to engineered and model system, So it has three major domain for designing i.e. 'Input processes and output 'as shown in model. In input intelligence engineering for Humanoid major emphasis on "Sensation Intelligence Designing" like voice sensing and recognition engineering , Touch Sensing and Recognition Engineering , Image Sensing and Recognition Engineering and Smell & Test Sensing and Recognition Engineering " those are themselves very broad subjects of research and engineering in the field of Humanoid Robotics and are very essential. The next most important and serious issue of engineering is "Intelligence Process and Controls" *Shaikh.)*

This is second explored model of mine and labeled "Layered Diagram of Humanoid Robotics" In this model major emphasis not on hardware (BODY) ,but

designing i.e. strong-AI Neural schema's and implementation, most favorable "Bionic (Bio-electronic) Brain", over which I already discussed and wrote. This is the very challenging engineering domain in Humanoid

Software(SOUL) part and segmented into four layers L1,L2,L3 and L4 with 'Robotics hardware , AI –Neural Robotics and example is "ASIMO" manufactured by

HONDA one of the successful HUMANOID. The areas of engineering are numerous here but I am giving to enlist

some important like "Arithmetic intelligence engineering , logical Intelligence Engineering ,Reasoning and decision- making Intelligence Engineering , emotion, feelings, expression intelligence engineering as well as self- learning & memorization intelligence Engineering ".The last phase of this system development is Actuation Intelligence Engineering, which really challenging and very interesting algorithm , This is challenging is because of have intelligence computer robotics programs synchronized and execute to Hardware (BODY) of Humanoid and interacting because of we going to give human-like thinking and motions(movements) to machines. This phase also called output system engineering of Humanoid which following important field "speaking/communication intelligence engineering, motion/movement intelligence engineering, folding/Bonding/Joint movement/control engineering and clutching, Climbing, walking intelligence engineering ". The first of field may be increase according to dynamism in Humanoid, but not would be less of this.

2.4. Intelligence Domain Model (IDM) (See Annexure-3 for Figure)

With continuation to all previous engineered models, now I would like to clarify the concept of intelligence domain and according to it type of intelligence and how we able to categorized it . Hence for the answer of all these questions I developed "Intelligence Domain Model (IDM)" I received studies and conformed from various literature source Artificial Intelligence (AI) classified into two types "Weak A.I and strong A.I ", where weak A.I is very poor (low) with intelligence, creating and problem-solving skill as well as completely user's (Programmers) dependent programming i.e. Autonomy is very low, therefore needs more programming guidelines. Some examples of weak A.I implementation are Microprocessor/Microcontroller based system, smart electronic gadgets, Toy's, Smart Phone, Kitchen appliances, home appliances like CD-Player, T.V, DVD Players , Microwave Oven, Washing Machine, Refrigerators, Cars, Bikes , and all electronic logic based and control devices , instruments, Automobiles Aerodynamics and so on. Hence in short weak-A.I only suitable for Non- Humanoid Robotics or Industrial Automation/Robotics or Smart consumers electronic appliances, gadgets and so on. Here is intelligence exist but not suitable for Humanoid , because weak-A.I only the engineering of some functions and processes of Natural brain, but not complete human brain i.e. Natural Intelligence copied on silicon wafer i.e. electronic data processor (EDP) with some function of brain. But for Humanoid Robotics complete natural intelligence (i.e. Biological brain) needs to engineer artificially (i.e. Bionic or Bio-electronic) brain or Artificial Intelligence which performs function similar likes human brain by human being. Hence strong –A.I implementation only solution front of us. Strong- A.I is most suitable for Humanoid Robotics because level of intelligence creating and problem-solving skills are high , smart and self-learning programs ability is also high, thus needs less programming guidelines and Autonomy is high for examples , Neural –schema's , Bionic brain, Neural network and genetic algorithms , Natural language processing and genetic algorithm to get in depth knowledge of it.

2.5. AI Routing Model (AIRM) (See Annexure-4 for Figure).

This model is not about to give you knowledge about how Humanoid Robotics engineering is carried out, but instead of it this model help you how to start research in Humanoid engineering, and what channels available and how to positioned yourself for concise research thus I labeled this model as "A.I Routing model (AIRM)", this model finalized research channel in the field of Humanoid Robotics moved engineering in correct direction. To start research in Humanoid very first must have to studies Human(Natural) Intelligence, that functions and processes of Human brain and Biological Neuroscience i.e. how brain accept data ,process and control information through Neurons and Neural Network . It can be possible with the help of psychologist, Neuroscientist etc. Then after at next move is how to engineered advanced digital/optical/quantum logical electronic circuits using semiconductor technologies advanced tools like ULSI and Nano circuits etc., and finally how can engineered and assembled" Artificial Intelligence (i.e. copy of Natural Intelligence (Human Brain)) which is GOD made on silicon wafer which is MAN made, so called A.I using digital logic ICs, quantum /optical circuits and programs for them. After the successful unit testing we must have to think about how could we able to engineered "strong-A.I" with integrating and engineering all these advanced Intelligence assembled units/parts/block/programs modules etc.. This represents to brain-like processing ability through machine. When we engineered such string -AI using Neural Schema's and Network ,we can further able to combined/cascade all strong AI human-brain like multi-functional intelligence modules to engineered "Bio-electronic(Bionic)" brain i.e. Manmade artificial brain work similar like God made Natural Human brain to fit in Humanoid.

2.6. Bionic Brain Engineering Model. (See Annexure-5 for Figure)

This is the last model I traced present and future considerations in Humanoid engineering with special preference to "Bionic Brain" hence named it "Bionic Brain Engineering Model (BBEM)". This model is further segmented into 8 segments of Bionic Brain Engineering like 'sensation process & control engineering' which reach environment stimuli's up to Bionic Brain of Humanoid i.e. how to sense and process input signal from human & environment through sensor using intelligence software supports. Second is 'Actuation Process & control engineering', for output human like response

engineering segment also need to well synchronized intelligence software with physical body i.e. hardware parts of Humanoid Robot like motors, joints, pneumatic units & control, storage, logical processor, buffers, servo motors and so on. Next important engineering is ' Data information processes & control engineering' i.e. how robots accept & process voice signal, text, images, smell, touch and likewise several signals as well as identify & control them during processing. Next is 'Human Intelligence mimicking 'into sub-routine, sys-calls, procedures, genetic Algorithms, Neural Network, Neural Schema's and so on. Next and very important domain of Bionic brain engineering for Humanoid is 'self-learning programs and futuristic logic for possible self-learning. Simultaneously algorithm forth engineering domain fifth domain must have to interfere with forth one i.e. 'Strong –

A.I 'and Strong –A.I agents, logic designing & programming for feelings, love, emotions, expressions, desires etc. One very important engineering aspect of Humanoid is also how could Human-like central processing control hardware possible to develop look like human body and skill & movement like human body. After this next engineering approach is ultra-low power consumption management i.e. designing of small, highly dense, durable, reliable with high density of storage, memories, buffers, storage required, generally where energy sources are inbuilt and rechargeable to give mobility and autonomy to Human Robotics.

3. Conclusion

Although a clear business model has not yet been devised, humanoids are currently being developed in Asia, the United States, and Europe. The early systems, which are utilized as test beds to develop walking, manipulation, and human-interaction capabilities, are costly and fragile. The possibilities are endless as these abilities develop and are combined with more sophisticated machinery. The only unanswered concerns are who will create the first "Model T"-equivalent system and when these future humanoids will be feasible. There are two reasons why interest and investment in humanoids won't be restricted by the absence of a clear business model. First, there is a cultural and emotional desire to create machines that resemble and function like people. The U.S. interest in the perils of humanoids portrayed in American science fiction is only surpassed by Japan's enthusiastic use of robot technology. A third perspective is the Korean emphasis on humanoids as a component of a highly networked and pervasive urban environment, where mobile, human-like robots that can be updated faster than a house progressively replace building-integrated systems. Many of the existing prototypes are seen as "mascots," representing the future and the aspirations of their developers to take the lead. Humanoids will elicit strong feelings and views wherever they go, ranging from love to hatred. However, there is a tremendous desire to construct them that is not driven by short-term

economic considerations. Humanoids are inevitable for a second reason. They cover a wide range of robotics fields. Although it hasn't been achieved yet, the archetypal humanoid will be able to move like humans over the majority of terrain. They will be able to carry out value-added tasks, such as creating with hands inspired by human limbs, deftly manipulating items, and utilizing tools. They will blend in with our culture without any problems, but as technology advances, they will eventually take over duties that are better suited to humans. They will be able to move through our culture, fit into our structures, and work with current things. Humanoids are an incredibly comprehensive system design that integrates navigation, perception, manipulation, and cognitive research. This form's completeness produces a spectrum of functions that are impossible to overlook. If a humanoid platform was available and affordable, the majority of researchers could utilize it for their study now. In the minds of 20th-century science fiction authors, the robot sprung from the humanoid. It seems that the engineers are now in charge. Humanoids will stride, roll, or sprint into our world in the twenty-first century, leaving the pages of fiction behind.