**‘I, Robot’, an essay discussing the portrayal of Artificial Intelligence (A.I.) in media when compared to recent A.I. Developments in Utility-Based Agents and Finite State Machines (FSM’s):**

Intro:

Artificial Intelligence (A.I.) refers to the theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition and decision-making.

The idea of A.I. has been explored as a concept for a very long time, however it was not ‘officially’ coined until a conference in 1956.

As media such as film developed in complexity and capability, in part thanks to advances in computer and graphical technologies, so too did the portrayal of A.I. These portrayals include the omnicidal machine gestalt ‘Skynet’ from the ‘Terminator’ franchise, the curious and introspective android ‘Lt. Data’ from ‘Star Trek: Generations’, the iconic shipboard intelligence ‘Hal 9000’ from ‘2001: A Space Odyssey’, and the servile ‘Nestor-Series (NS-X)’ of Robotic servants found in this essay’s focus; ‘I, Robot’.

‘I, Robot’ is a science-fiction film released in 2004, depicting a near-future dystopian version of Chicago in 2035, where humanoid robots serve humanity, which is purportedly protected by “the Three Laws of Robotics”, a schema hard-coded into all robots intended as a safety feature.

‘I, Robot’ has been chosen as it provides good examples of Utility-Based agents.

Main:

A Utility-Based Agent is a kind of rational agent, which can make decisions based on environmental perceptions through its sensors, and take actions through the use of actuators in response to, or in anticipation of changes to its perceived environment. In a Utility-Based Agent, the information about the environment gathered by its sensors is resolved into the current world-state and agent-state. The world-state may be updated by the Agents own understanding of how the world evolves, i.e. an object in motion will remain in motion unless acted upon. The Agents current state, along with the world state can be further changed by the Agents available actions. Utility, as defined by a utility function, is a measure of action induced state change in either or both of the Agent and the world. Each action available to the Agent therefore has a given utility to the Agent. The Agents state is a measure of how “happy” it is, or how close to a given goal it is. A Utility-Based Agent thus evaluates the impact of its potential action(s) and plots a path to maximise utility and thus Agent happiness, in pursuit of a goal.

In the science-fiction film ‘I, Robot’, the ‘Nestor-Series’ of robots, the NS-4’s and NS-5’s, are examples of complex and compound A.I. agents. Each NS robot has a positronic brain which acts as multiple kinds of inter-dependant agents, and in some regards, as Finite State Machines. For the purposes of this essay, the NS robots positronic brain is abstracted as the defining source of the robots utility function, action ‘library’ and overall agent goals. While the robots body is considered as the actual Utility-Based Agent discussed in this essay.

With this in mind, the NS-4’s depicted in the movie are capable agents, able to navigate dense urban terrain populated with both chaotic human elements and other Utility-Based robotic Agents. NS-4’s, later in some instances NS-5’s, are shown as domestic servants, public service workers, menial labourers, able to perceive their surroundings and efficiently navigate through the environment while completing their assigned task and observing the overarching “Three-Laws of Robotics”.

While technical specifications of the NS robots aren’t explored in any real depth, it can be inferred that the robots have sensors providing; sense of sight including a large part of the electro-magnetic spectrum (to see, identify and asses any humans present, then it’s environment), sense of hearing (to hear human commands, or humans in distress), sense of touch (so they don’t apply excessive force when handling a human), and likely concealed additional sensors to provide some level of full situational awareness around the robot (low-power radar, sonar, etc).

As for actuators, the NS robots have two arms, with hands, capable of hydraulic press like grip strength, two legs, capable of launching the robot tens of feet into the air, and lastly a head containing the positronic brain, primary optical sensors and a speaker that serves as the robot’s mouth. The arms are mounted to the robot’s torso, while the legs are mounted to the robot’s pelvis, the NS-4’s have an intermediary abdominal component that links the torso and pelvis, while the NS-5’s have a more human structural skeleton.

‘I, Robot’ was released in 2004, and depicted a near-future idea of what robots and by extension A.I. agents, might become. At the time of the movie’s release the robots as shown were reasonably realistic; performing feats that, while impressive, remained within the realms of possibility, even while being completely unfeasible to recreate on many levels. For example, the robot’s power-source is never mentioned, and the ‘positronic brain’ that drives the robots remains a purely fictional technology.

When compared to the present day – March 2023 at time of writing – however, the robots remain as reasonably realistic as their original depiction yet have become far more feasible to partially recreate in the near-future.

The real-world contemporary to the NS-4 at present would be Boston Dynamic’s AtlasTM; “Atlas is a research platform designed to push the limits of whole-body mobility.” -[Atlas™ | Boston Dynamics](https://www.bostondynamics.com/atlas). Atlas is a humanoid robot, capable of navigating within a managed environment and performing simple tasks correctly, some of the time. As it is still in active development and, a research platform to boot, Atlas still has trips and falls.

The Atlas platform is a Utility-Based Agent, like the NS-4’s, regarding its action ‘library’ and ability to move through an environment; “…Atlas uses models of the robot’s dynamics to predict how its motion will evolve over time and adjust accordingly.” -[Atlas™ | Boston Dynamics](https://www.bostondynamics.com/atlas).

Finite State Machines:

Conclusions: