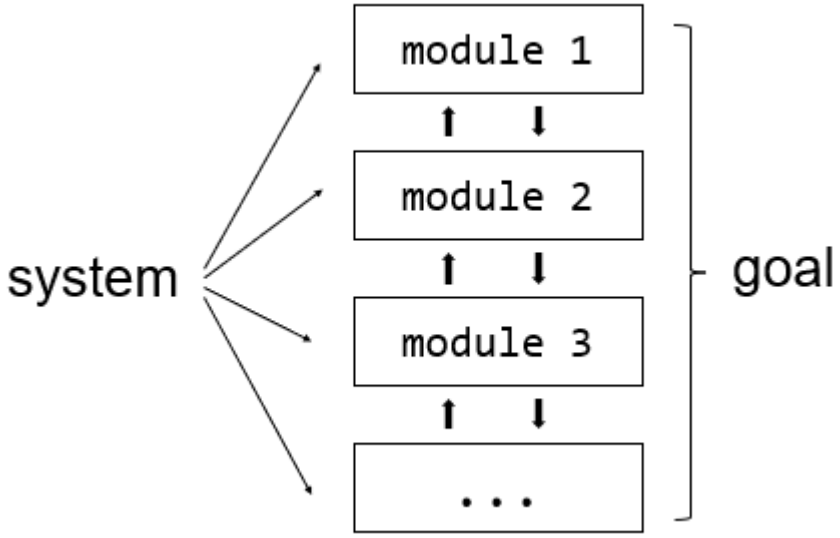
Lesson 2 - Overview on Intelligent Systems

What is a `system`?

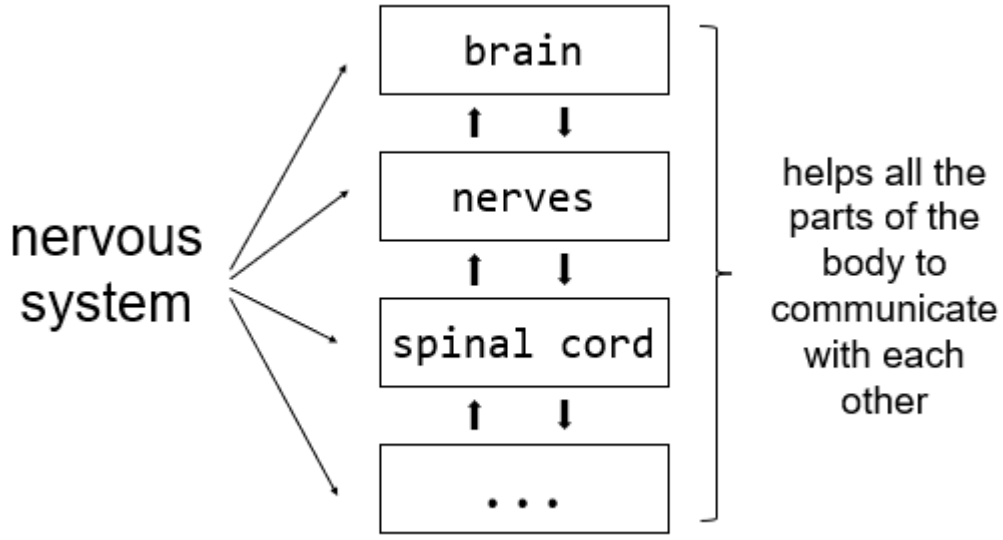
A system is an assemblage of parts with structure, connectivity, and behavior. It has modules that are related to each other which interact to meet a common goal. A system has objects, and these objects are divided by boundaries. Objects respond to externalities.



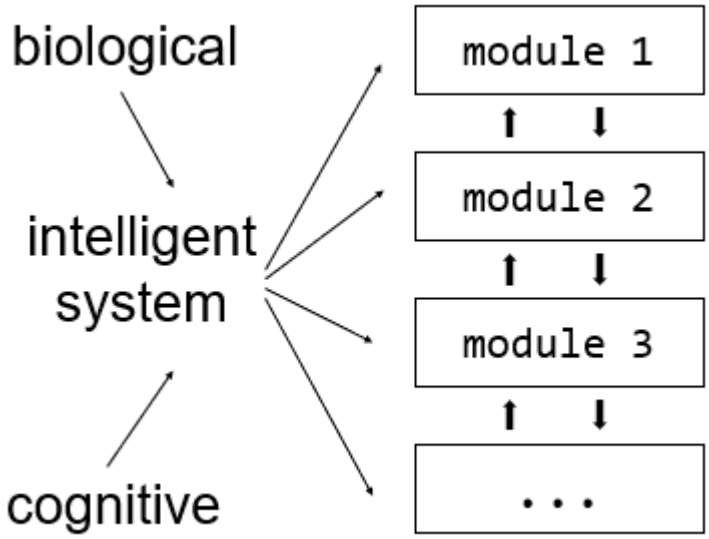
Example - `nervous system`

Setting an example is our nervous system. It has parts composed of the brain, nerves, and spinal cord. These parts or so-called modules have their purpose but interact with each other so that the system functions well. If say, for instance, you suddenly touched a hot object, this signals the nerves going to the brain and as a response, you immediately remove your hand. This incident can be

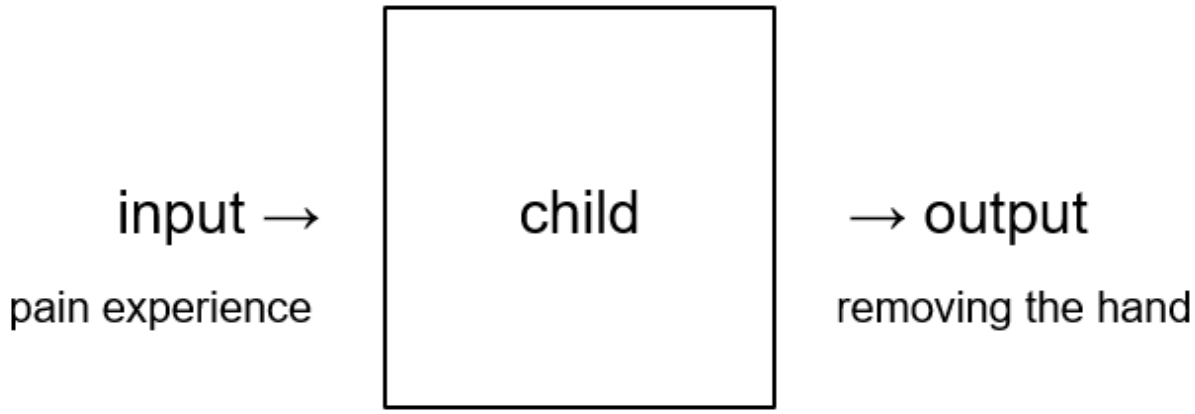
called the externalities. The system responds to the input from the externalities and creates an output. The input is the heat while the output is you, removing your hand.

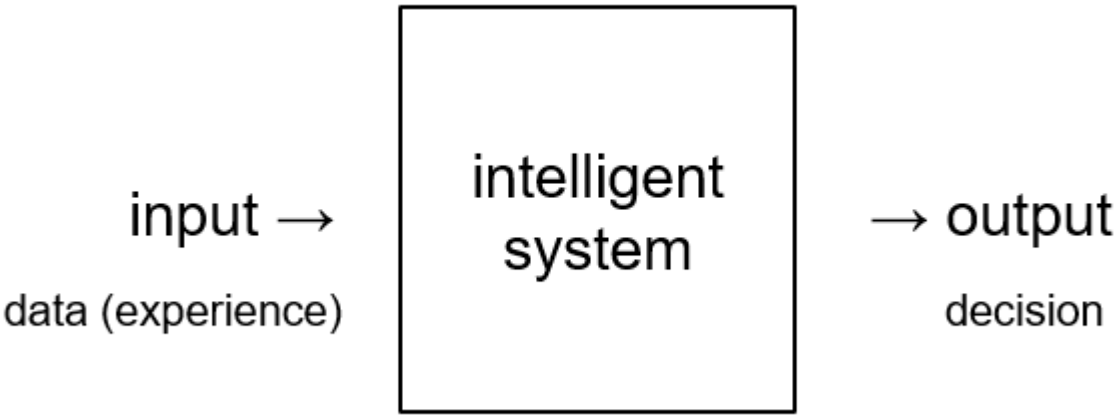


What is an `intelligent system`?



An intelligent system is a system - means it does have functions/modules - which is driven by the desired goals using its current knowledge.Intelligent systems emulate biological and cognitive processes. What do we mean by this? Human in general learns based on what they see or based on their experience. A child does not hold hot objects once they experienced that by holding them, it may bring pain. In analogy, intelligent systems also learn by example or by experience.

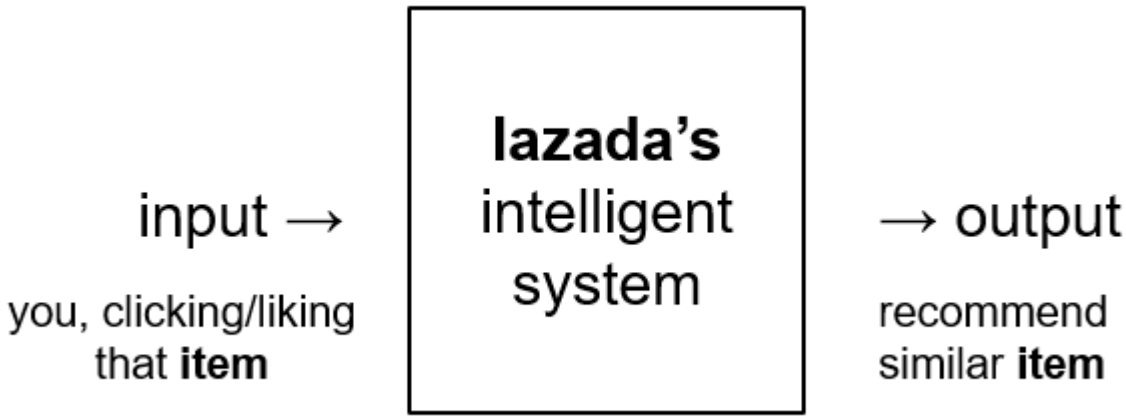




Example - `recommender systems`

Recommender systems are types of intelligent systems that aimed to suggest relevant informations to the users.

1. **Lazada/Shopee**: Let us take an e-commerce site as an example. In an online shopping platform, have you ever noticed that if you recently `liked` or `clicked` an item say a cellphone, your feeds show items having the same or which are related to a cellphone? What is even weirder is when you purchased or even searched on this e-commerce site, these products would also show on your feeds on Facebook.



2. **Facebook**: Also, in social media sites like Facebook, whenever you `react` to a post, you'll notice that in your timeline you'll also get similar suggestions of that post (images or videos).

3. **YouTube**: Have you also ever wondered that when you start to `listen` or `watch` to a pop song on YouTube, all of the succeeding or recommended music is generally in that same genre.

The government is not spying on you, it is just that these platforms are using intelligent systems. The system is learning based on your data to have a knowledge that you are interested in the cellphone or pop music.

Challenges in `intelligent system`

Research in intelligent systems faces numerous challenges, many of which relate to representing a dynamic physical world computationally.

1. **Uncertainty:** Physical sensors/effectors provide limited, noisy, and inaccurate information/action. Therefore, any actions the system takes may be incorrect both due to noise in the sensors and due to the limitations in executing those actions.
2. **Dynamic world:** The physical world changes continuously, requiring that decisions be made at fast time scales to accommodate for the changes in the environment.
3. **Time-consuming computation:** Searching for the optimal path to a goal requires an extensive search through a very large state space, which is computationally expensive. The drawback of spending too much time on computation is that the world may change in the meantime, thus rendering the computed plan obsolete.
4. **Mapping:** A lot of information is lost in the transformation from the 3D world to the 2D world. Computer vision must deal with challenges including changes in perspective, lighting, and scale; background clutter or motion; and grouping items with intra/inter-class variation.