

## 1. WHAT IS INTELLIGENCE

### OBJECTS

**Which objects in nature do we consider intelligent?**

Maybe a stone, a landscape, the sky, plants or trees? NO

What about the social life of honey bees? YES

The result of a trained guide-dog, which leads its master? YES

### SUBJECTS

**Only "living objects" can appreciate the intelligence of other "living objects" called subjects.**

Only subjects with sensors to perceive, a brain to think and limbs to act can be considered intelligent.

We describe the action(s) of one or more subjects as intelligent, only if we can fully understand them.

In order to understand other subjects, we have to imagine ourselves as being in the same situation.

### DECISIONS

**Intelligence is the result of a decision process for a certain situation with many alternatives.**

The decision process takes into consideration knowledge, obtained as own experience during lifetime.

Only by storing past situations and actions taken, can we remember everything what happened in our past.

When deciding on a particular option, the advantages and disadvantages of all possible variants should be weighed.

## 2. BIOLOGICAL INTELLIGENCE

### BODY

**The biological organism has unique features defining the framework for intelligent life.**

The organism consists as a network of cells, both for each part as well as for the whole body.

The body structure consists of specialized parts, such as sensors, actors (limbs) and organs.

The brain is an internal organ, connected in the same way with all other body parts (synapses).

### BRAIN

**The biological intelligence is the activity of the brain, its structure is a landscape of neural nets.**

The brain receives information via sensors, then processes it and further sends commands to the actors.

The brain has many different regions, each with its own specialty, for all given physical and mental abilities.

The brain is indispensable for intelligent life, autonomously coordinating all body activities in real-time, 24/7.

### EVOLUTION

**The brain has different levels of intelligence, depending on the general evolution of the body.**

The brain has genetic knowledge at birth, according to the corresponding body structure (species).

The brain can add knowledge via own experience by exploring the environment with many landscapes.

All knowledge, both pre-defined and accumulated, is stored in cells as ties between them (synapses).

### 3. TIPALO AI BACKGROUND

#### AI APPROACH

**Tipalo GmbH is a Swiss LLC near Zurich, an AI startup with own software to pioneer logic applications.**

The Tipalo approach to AI is very simple: we take biological intelligence as a template, means the living brain.

It needs a different mindset to comprehend and represent parts of the real world and replicate the human mind.

Our understanding of intelligence is based on logic, our AI concept contains objects reacting in time and space.

#### AI IMPLEMENTATION

**Tipalo AI simulates the activity of different brain regions in real-time, all the time and stand alone,** while being connected to a certain body hardware, which is equipped with sensors, actors and organs.

The VHDL implementation of our AI model allows massive parallel execution, without any processors.

This implies we do not use any math/statistics/algorithms, while no bias/training/inference is required.

#### AI KNOWLEDGE

**We use 3 intelligence levels, which exists in nature: insects, fishes/mammals/birds and primates.**

They reflect the amount of neurons and their synapses, from 1M with 16, via 1G with 256, to 10G with 1K.

Each level has pre-defined knowledge, to manage the body and the mind, together with some genetic memory.

The AI explores autonomously the environment and stores its own experience as accumulated knowledge.

## 4. TIPALO AI TECHNOLOGY

### AI PLATFORM FOR DIGITAL BRAINS

Tipalo develops own AI platform as software with biological features creating hereby digital brains with:

1. Real-time operating system in VHDL, simulates the activity of brain tissue via Programmable Neural Nets (PNN)
2. Self-Learning Mechanism (SLM), enables knowledge accumulation using Self-Associative Memory (SAM)
3. Artificial Nervous System (ANS), contains the brain landscape as map of all synapses, called connectome

### AI LIBRARIES FOR NEURAL COMPONENTS

Tipalo develops AI libraries with configurable reference designs based on PNNs for different ANS levels as:

1. Neural drivers for interfacing sensors, actors and organs of any kind, e.g. visual, limbs, rechargeable battery
2. Neural applications for various knowledge areas using SLM, e.g. identification, locomotion, task workflows
3. Neural storage for different memory types based on SAM, e.g. short-, mid- and long-term memory

### AI COMMUNICATION

Tipalo AIs can connect with each other, via sensors or wireless/cable, to communicate for:

1. positive identification, to enable the coordination of their actions for a possible common task
2. certain interaction, to enable the extension of knowledge by teaching each other new things
3. direct exchange, to enable the aggregation of information for a certain area of knowledge

## 5. TIPALO AI PRODUCTS AND SERVICES

### EDGE AI FOR EMBEDDED SYSTEMS

**Tipalo brains are linked via a single interface (gateway) to the body and perform intelligence for:**

Level 1, as managers for smart building automation, e.g. indoor manufacturing, outdoor surveillance

Level 2, as pilots for autonomous vehicles of any kind, e.g. terrestrial, naval, aeronautics, space

Level 3. as robotic workers for outer space activities, e.g. space stations, extraterrestrial planets

### CLOUD AI FOR TELEPRESENCE

**Tipalo brains can be connected via Internet to any embedded system or robot body,**

by using a connection with high bandwidth and low latency, like 5G or fiber glass.

Furthermore, the accumulated experience of many individuals can be aggregated, enabling the collective knowledge for a certain body type, e.g. autonomous vehicles.

### COLONY AI FOR VARIOUS ENVIRONMENTS

**Tipalo brains can be connected with each other in order to build a colony AI in a certain environment,**

this implies the spatial distribution of many connected AIs in a given landscape, both edge and cloud AI.

While the edge AIs is performing its tasks within the adjacent neighborhood and stores its experience, the cloud AIs aggregate the new information by areas of knowledge, making it accessible to everyone else.