

Introduction aux Signaux et Systèmes

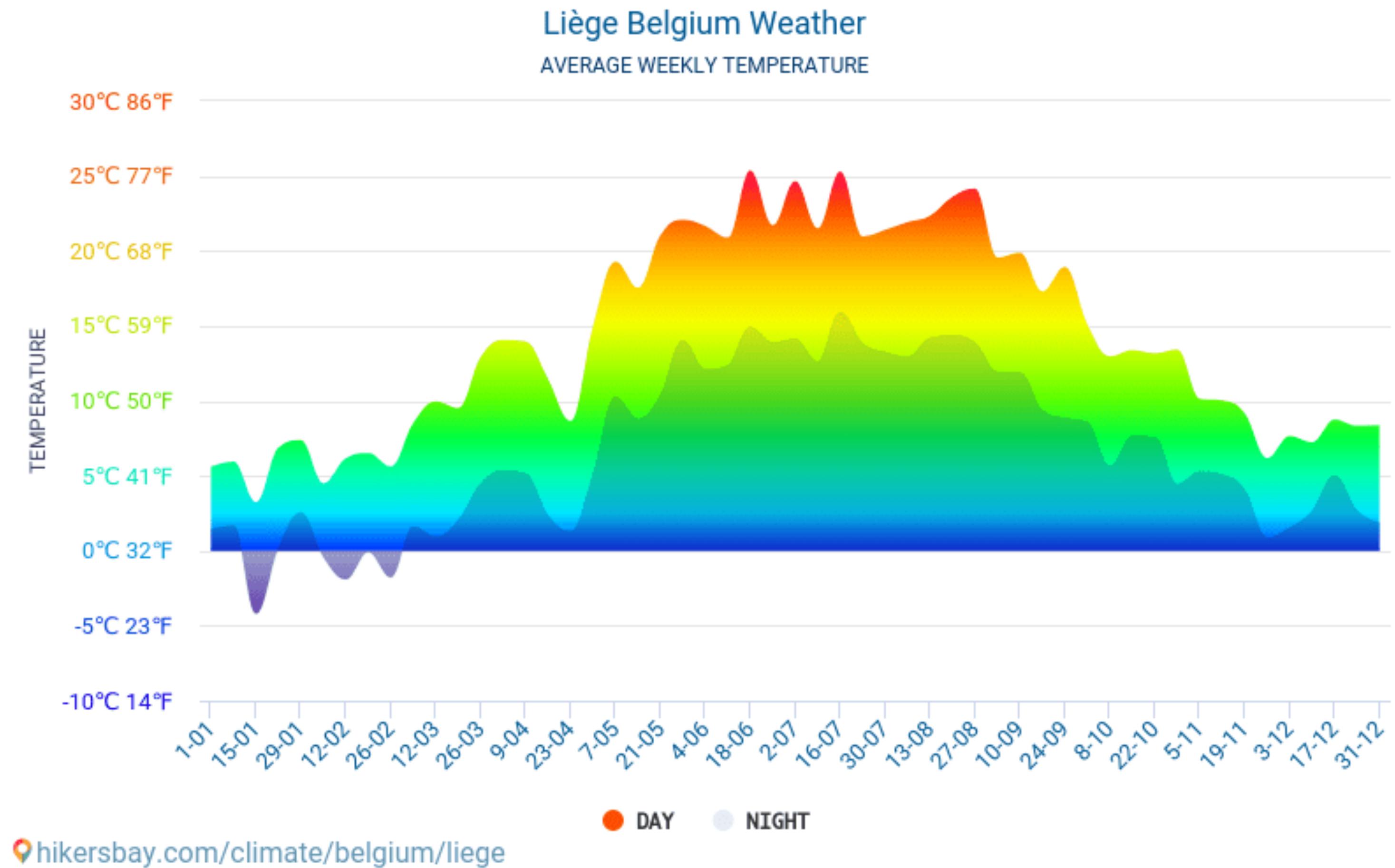
Motivation and background

What are Signals and Systems?

Signals

Any time-varying quantity

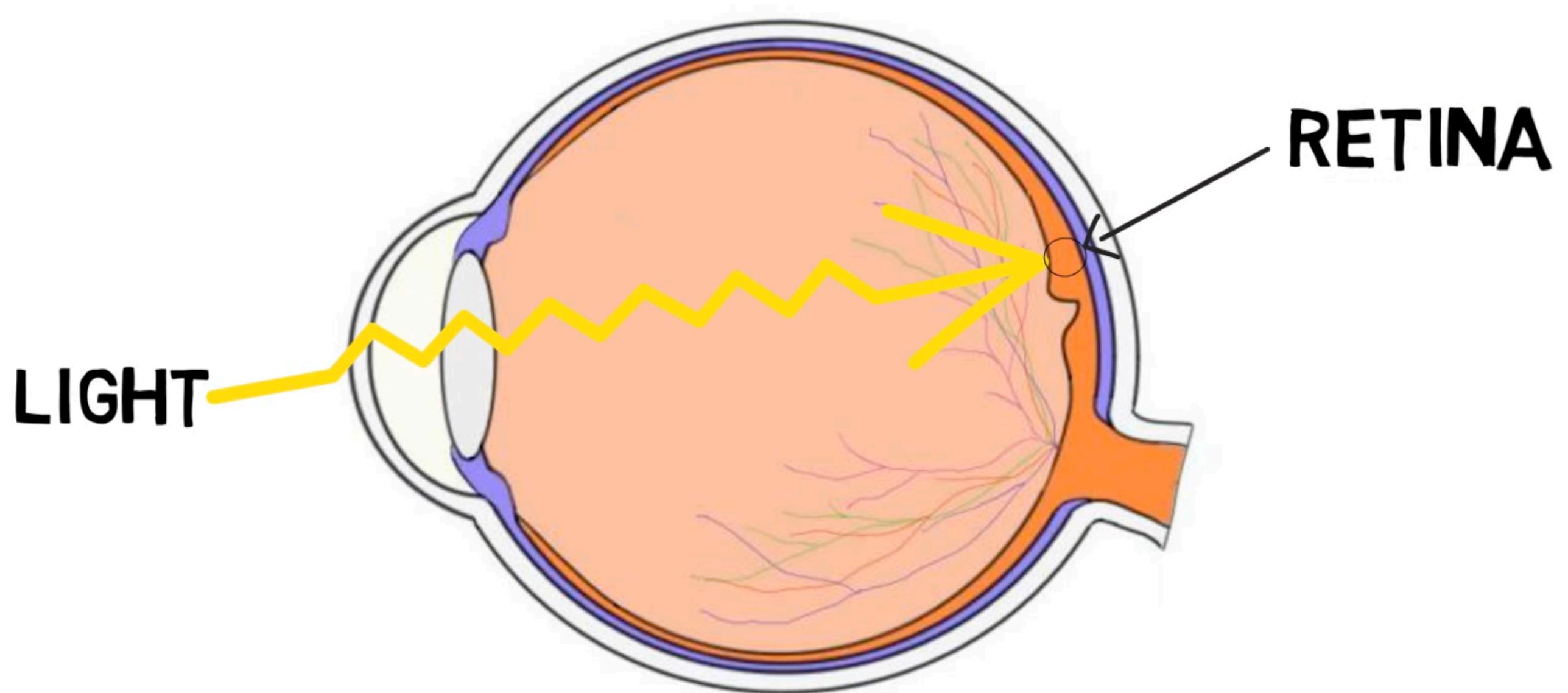
- Liege temperature



Signals

Any time-varying quantity

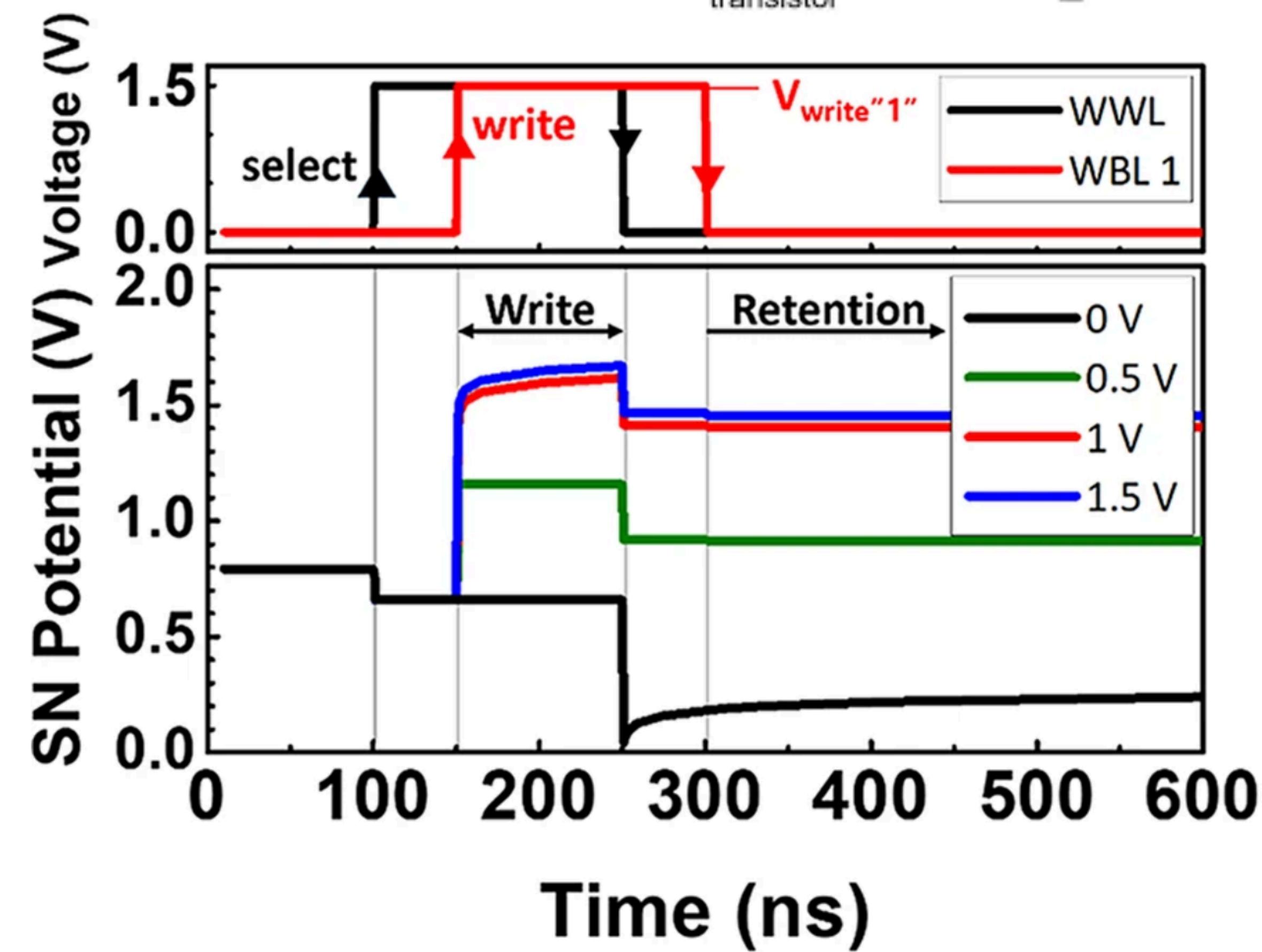
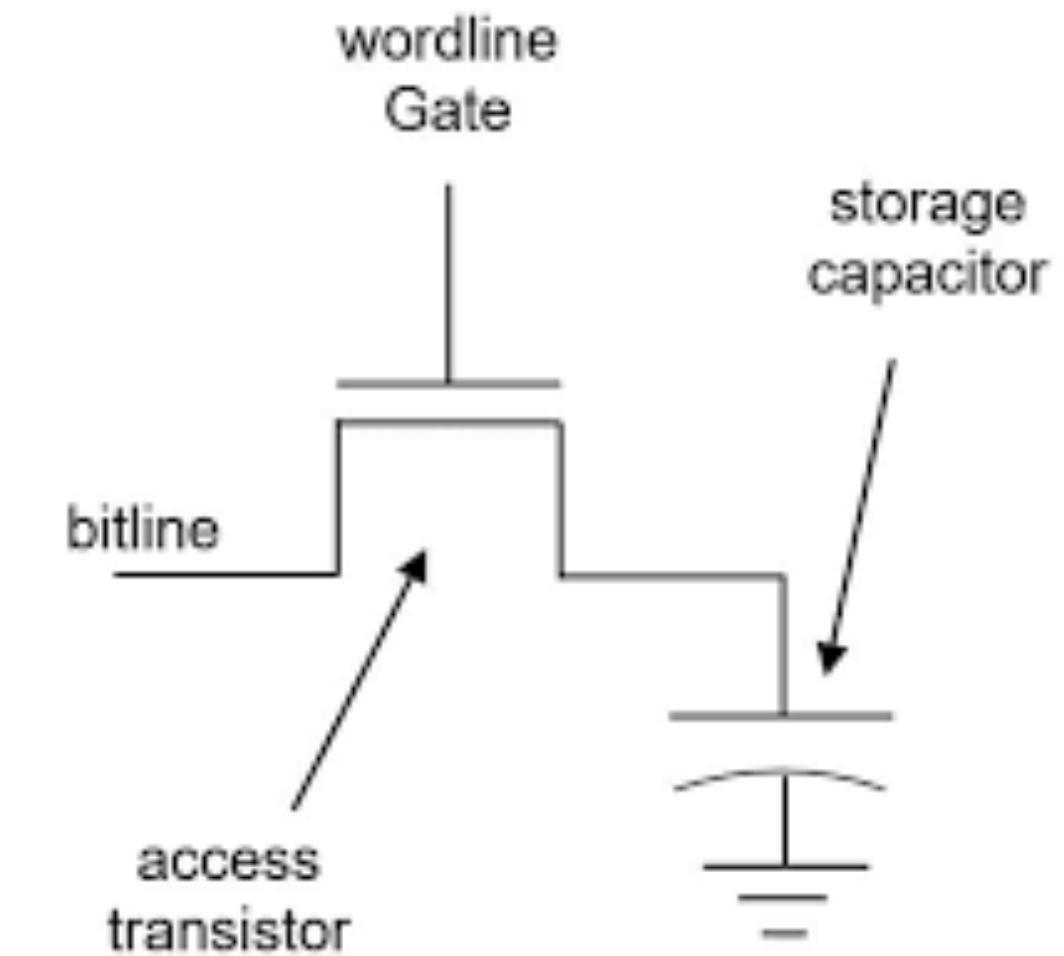
- Liege temperature
- **The amount of light hitting the retina**



Signals

Any time-varying quantity

- Liege temperature
- The amount of light hitting the retina
- **The voltage of a DRAM cell capacitor**



Signals

Any time-varying quantity

- Liege temperature
- The amount of light hitting the retina
- The voltage of a DRAM cell capacitor
- **The series of symbols in a social media post**

lemonssspaziali 🍋 VEGANUARY: BIANG BIANG NOODLES ALLO ZAFFERANO 🚀

🧅 con crema di aglio confit e carciofi croccanti

📌 Ingredienti

– Farina forte 400 g

– Acqua 190–200 g

- salsa di soia 1 cucchiaio

– Zafferano in polvere 0,2 g

– Sale 6 g

Signals

Any time-varying quantity

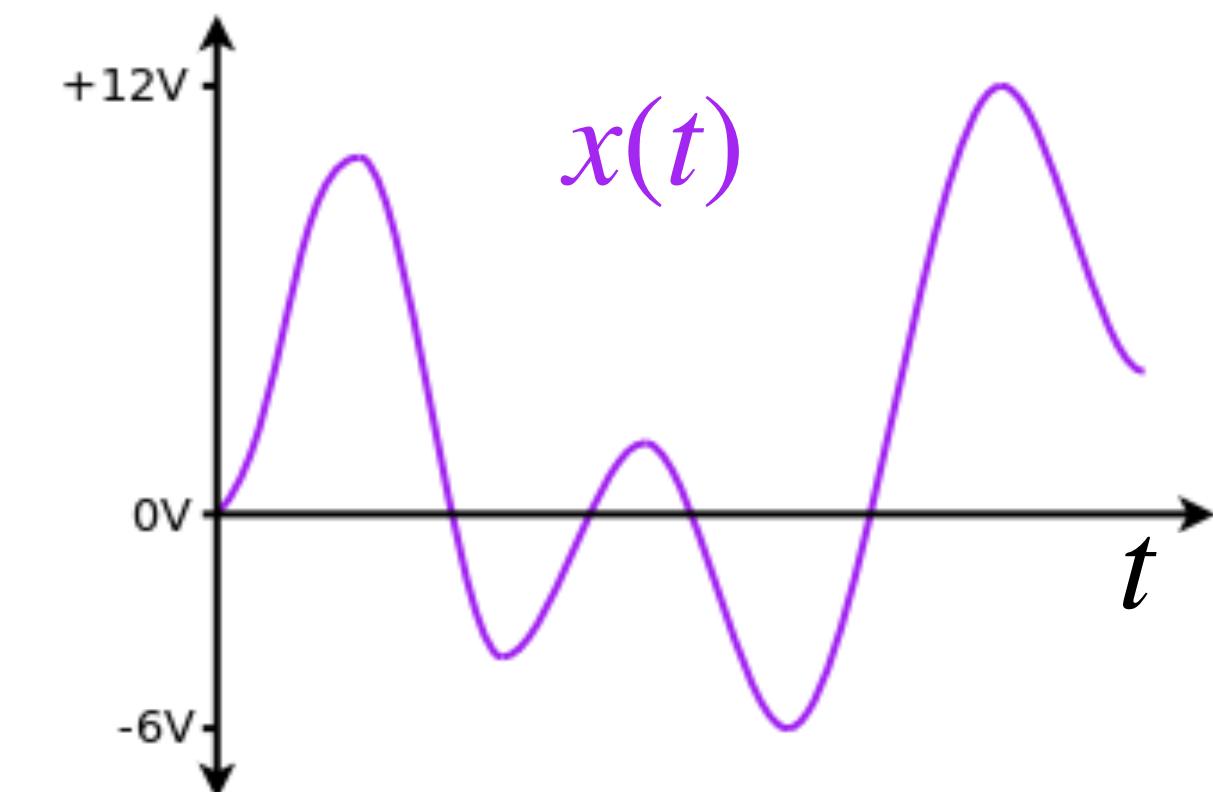
- Liege temperature
- The amount of light hitting the retina
- The voltage of a DRAM cell capacitor
- The series of symbols in a social media post
- **The strings of 0's and 1's in our digital devices**
- ...

```
11000110110010100111111111101  
110110001111011111010101100110  
0010111010011111000110001000110  
111111101000111111011101111110  
1011101011101000111111101111110  
0000010111011101111111111111  
111111001111001111110010111111  
111010111110111111101100111010  
0010100011111011110110100111101  
0011110010000000111100100100011  
1111000101110111000001001111110  
1111110011111111001100000110111  
0011101110000110010000001100111  
1000111110100011010111110010111  
1101010000110100111000100100010  
0000111110111111011110101111100  
0111111111111111110010101111111  
01111011001000110110110110011001  
11111100111110001111100111110101  
0101111011100110111110110011111
```

Signals

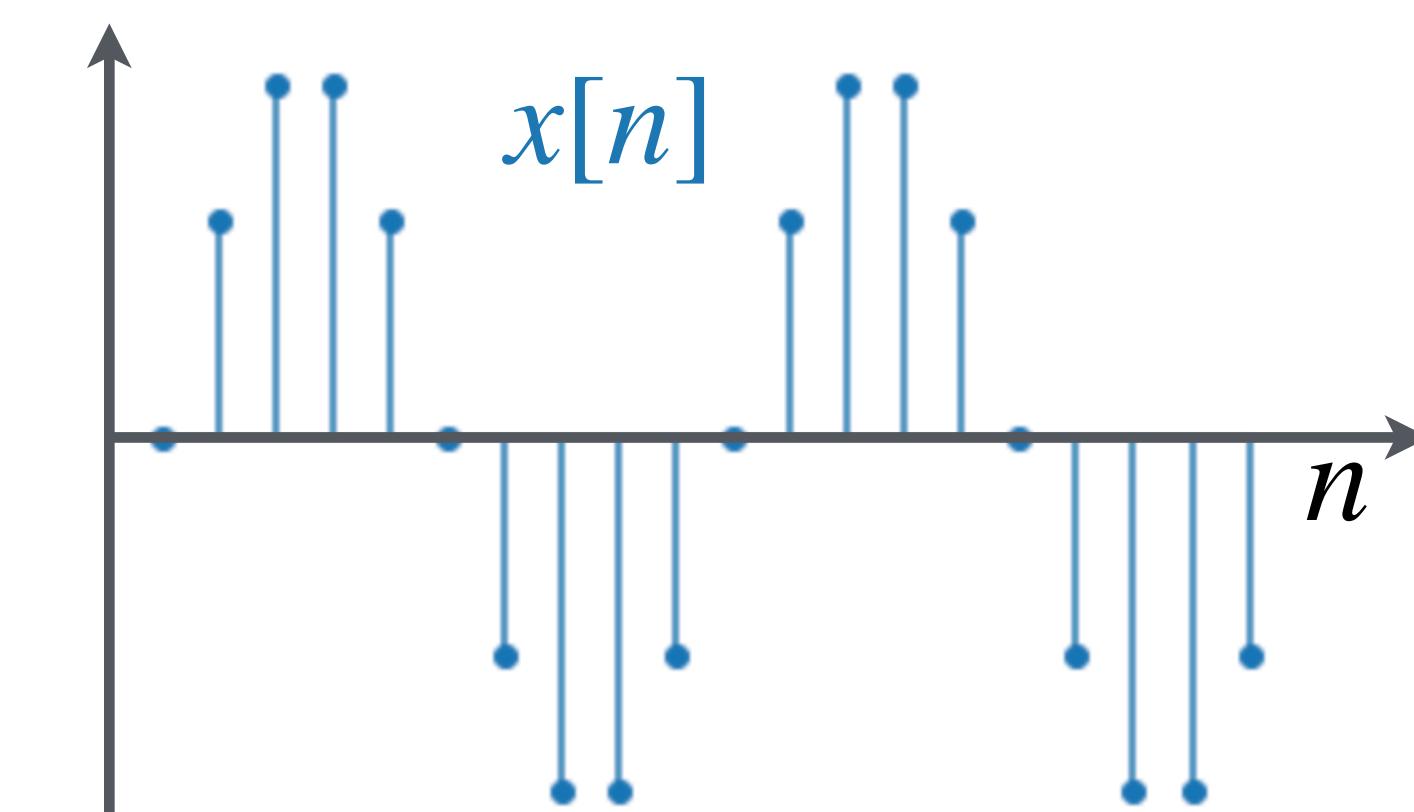
Analog vs digital

- Liege temperature
 - The amount of light hitting the retina
 - The voltage of a DRAM cell capacitor
-
- The series of symbols in a social media post
 - The strings of 0s and 1s in our digital devices



Analog = Varying continuously
(both in time and in value)

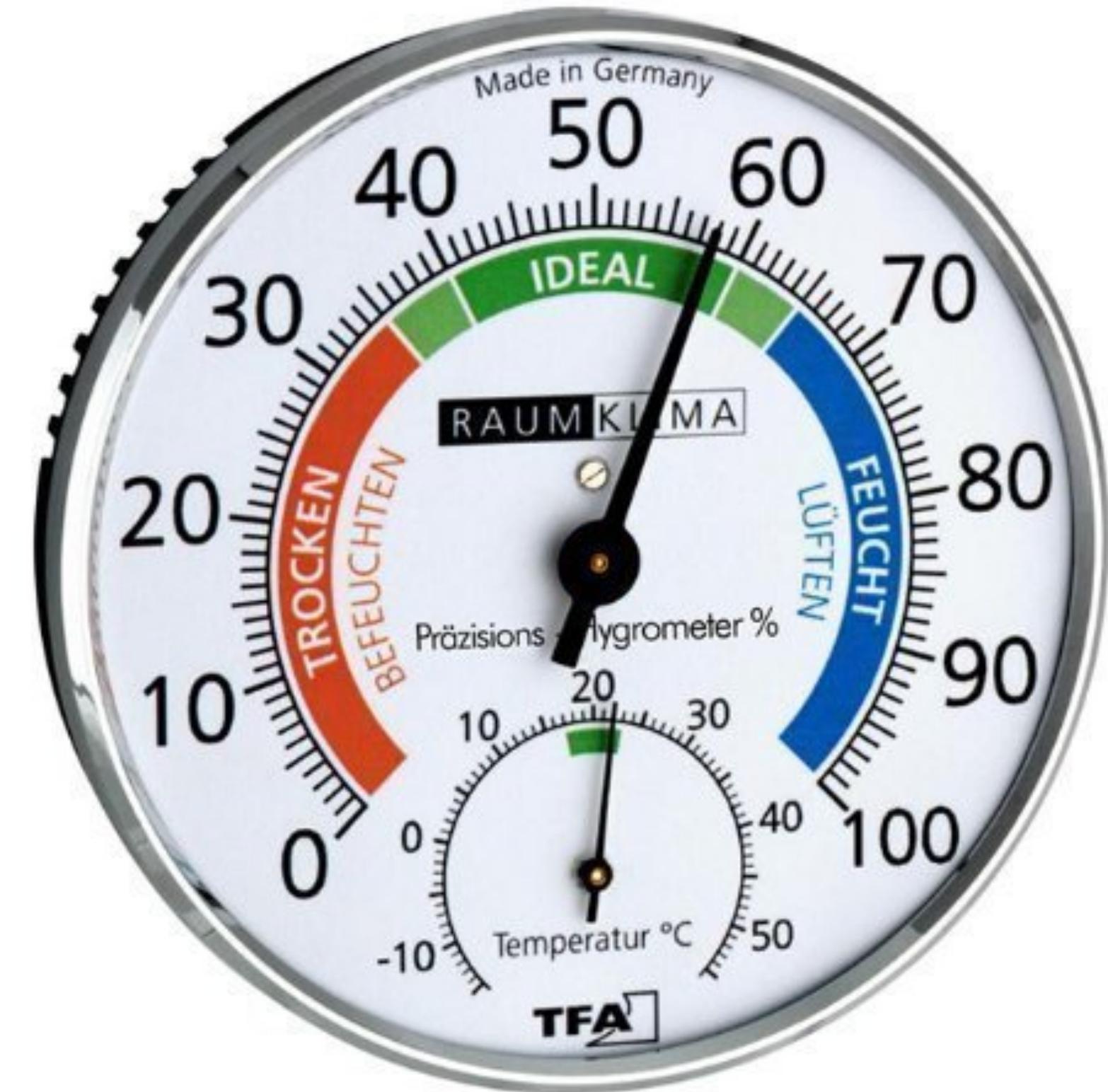
Digital = Varying in discrete steps
(both in time and in value)



Systems

Any entity that can process/transform signals

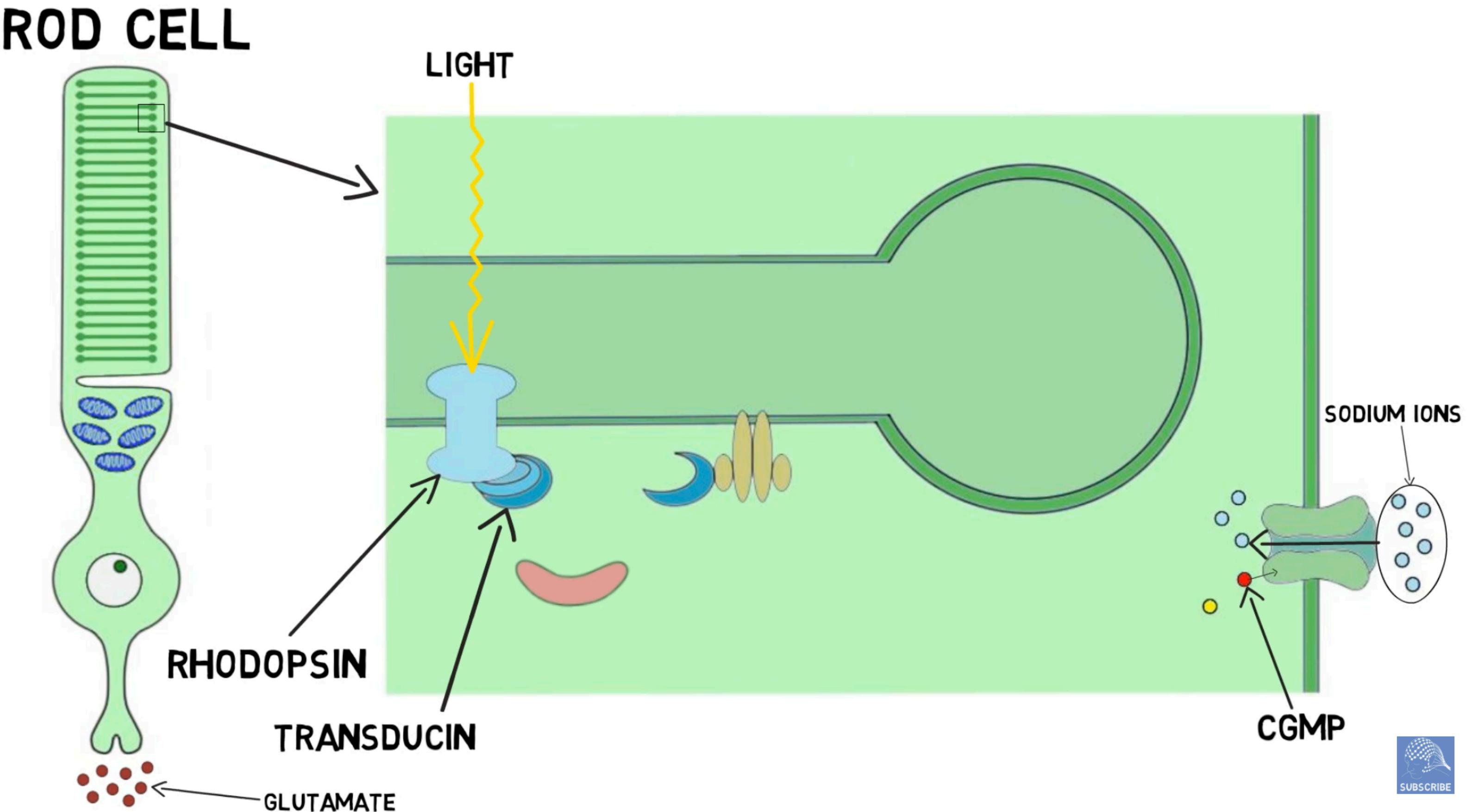
- **A thermometer**



Systems

Any entity that can process/transform signals

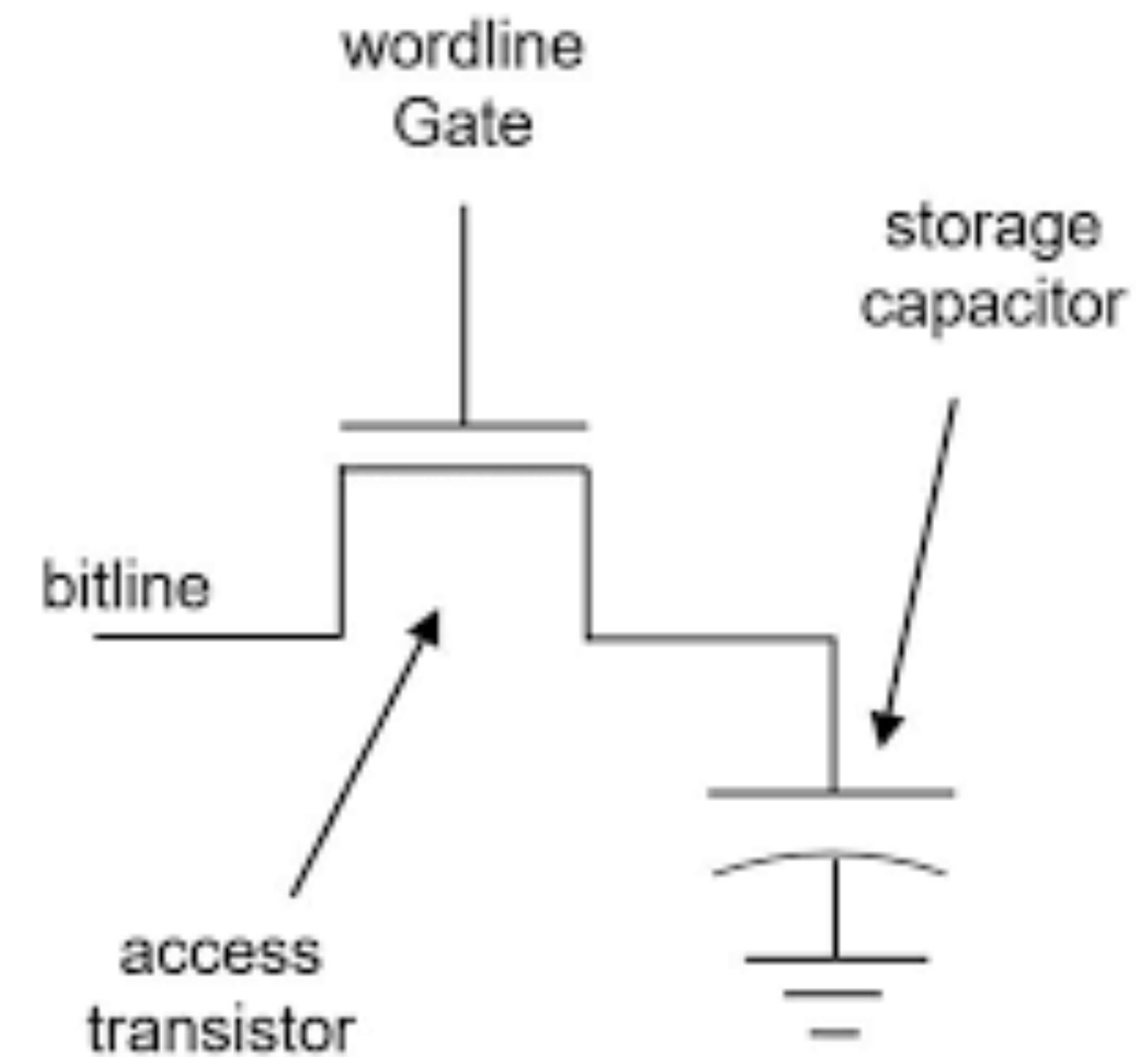
- A thermometer
- **A retinal photoreceptor**



Systems

Any entity that can process/transform signals

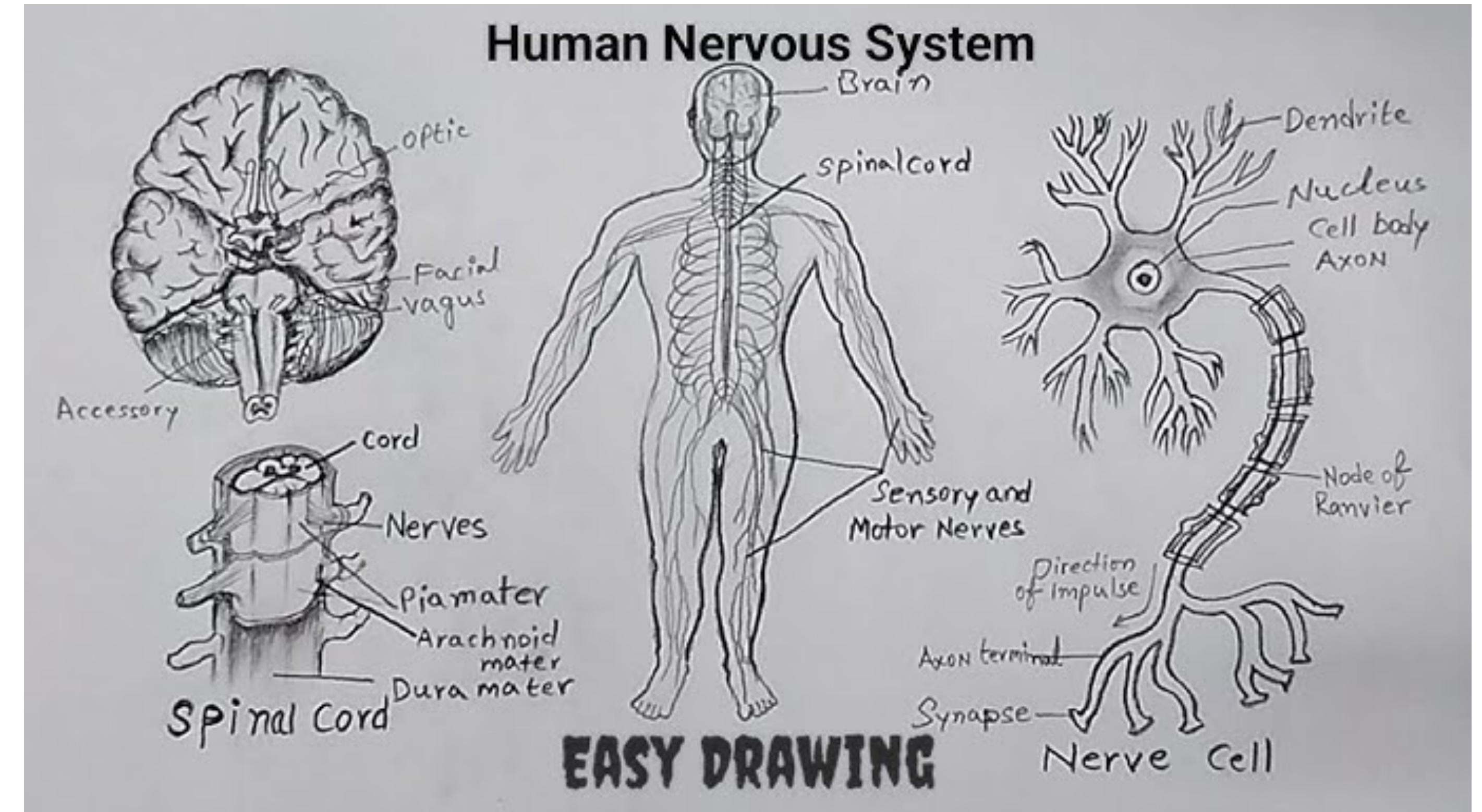
- A thermometer
- A retinal photoreceptor
- **A DRAM cell access transistor**



Systems

Any entity that can process/transform signals

- A thermometer
- A retinal photoreceptor
- A DRAM cell access transistor
- **Our nervous system**



Systems

Any entity that can process/transform signals

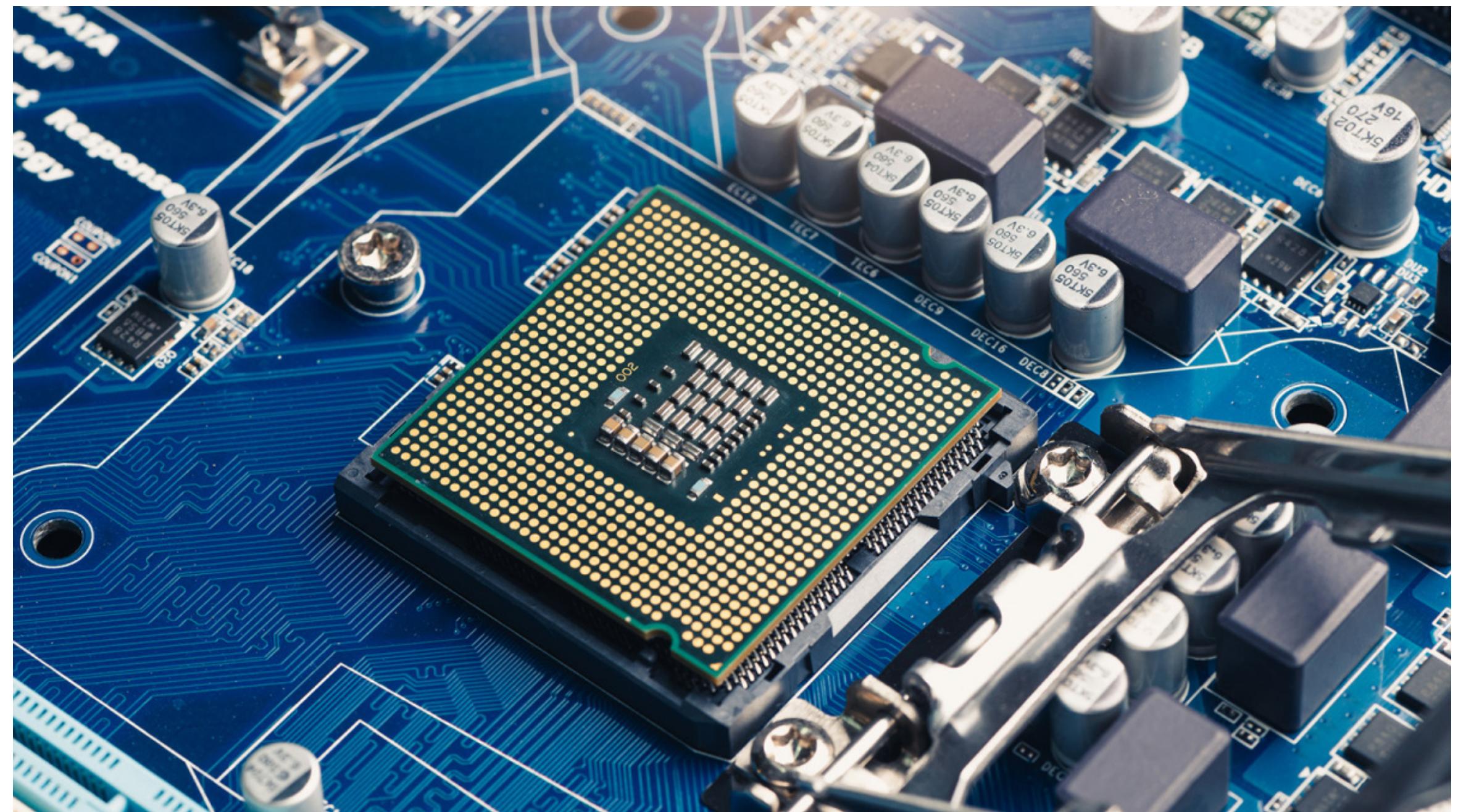
- A thermometer
- A retinal photoreceptor
- A DRAM cell access transistor
- Our nervous system
- **A Large Language Model**



Systems

Any entity that can process/transform signals

- A thermometer
- A retinal photoreceptor
- A DRAM cell access transistor
- Our nervous system
- A Large Language Model
- **A CPU**
- ...



Systems

Any entity that can process/transform signals

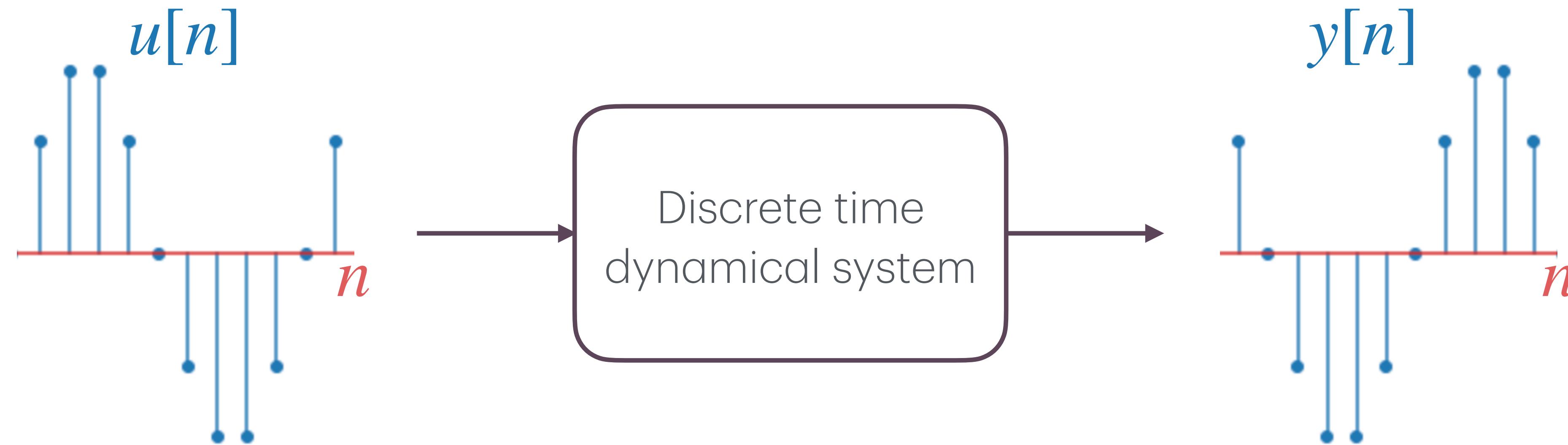
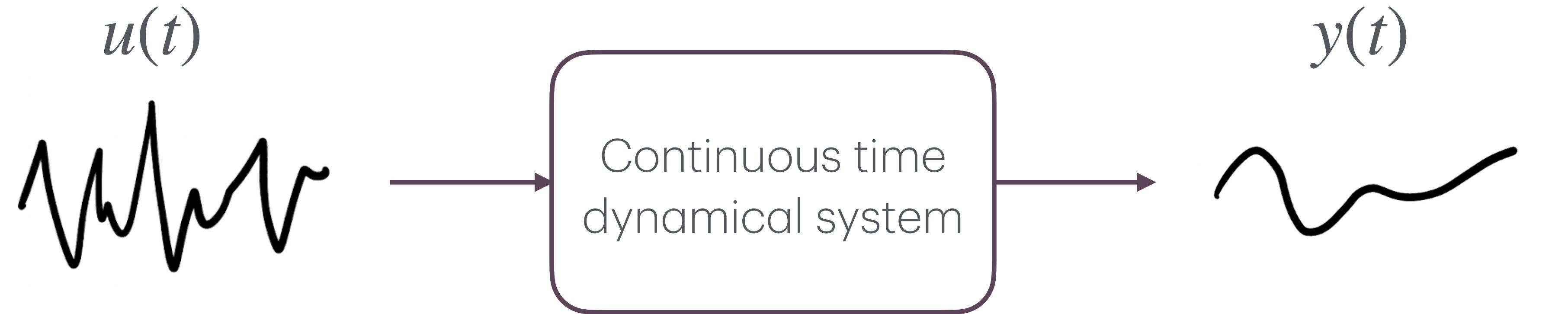
- A thermometer
- A retinal photoreceptor
- A DRAM cell access transistor
- Our nervous system

Continuous time systems

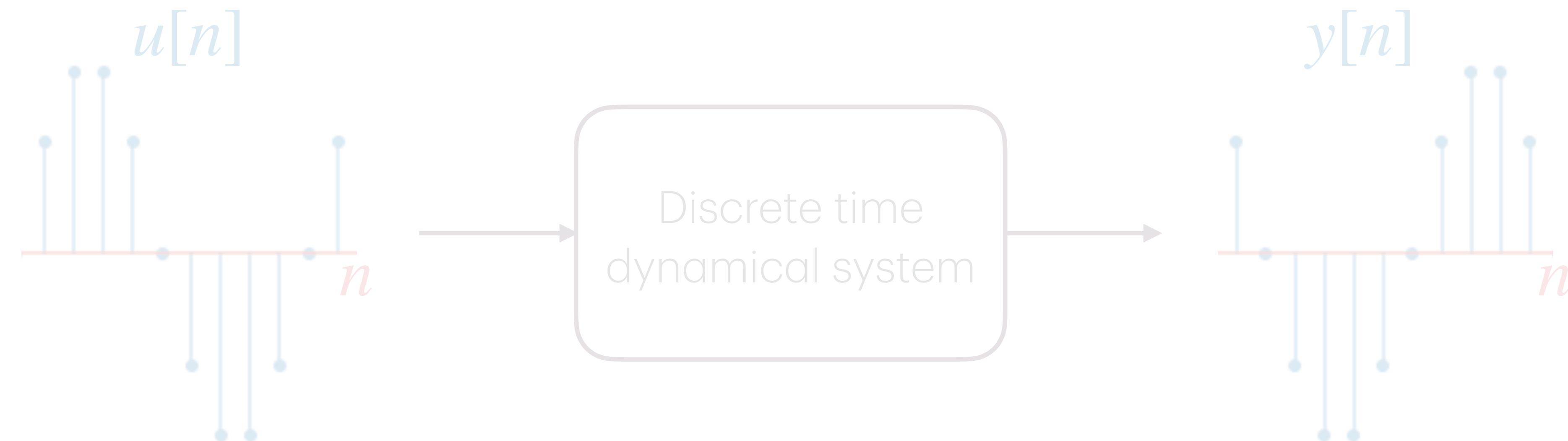
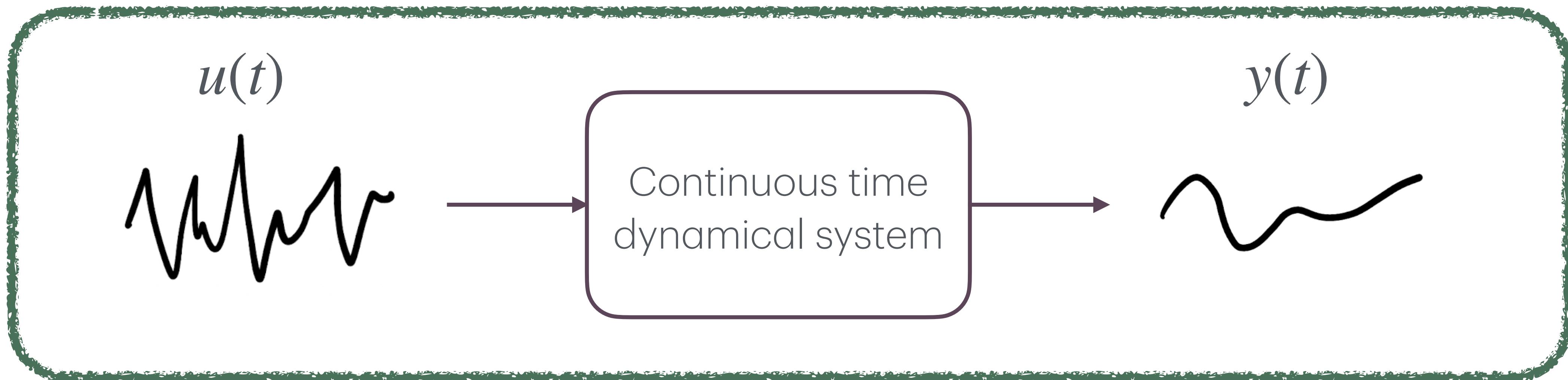
- A Large Language Model
- A CPU

Discrete time systems

Continuous vs discrete time systems

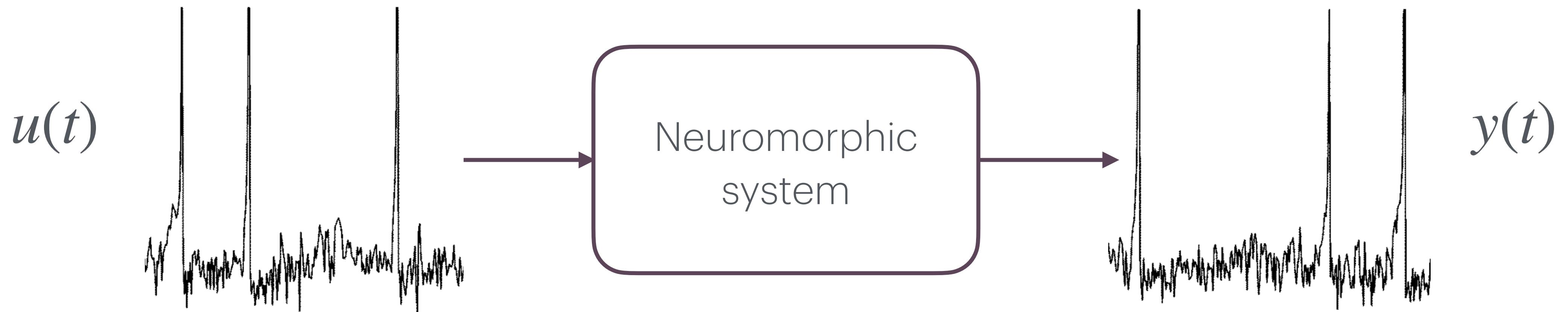


The signals and systems we will study

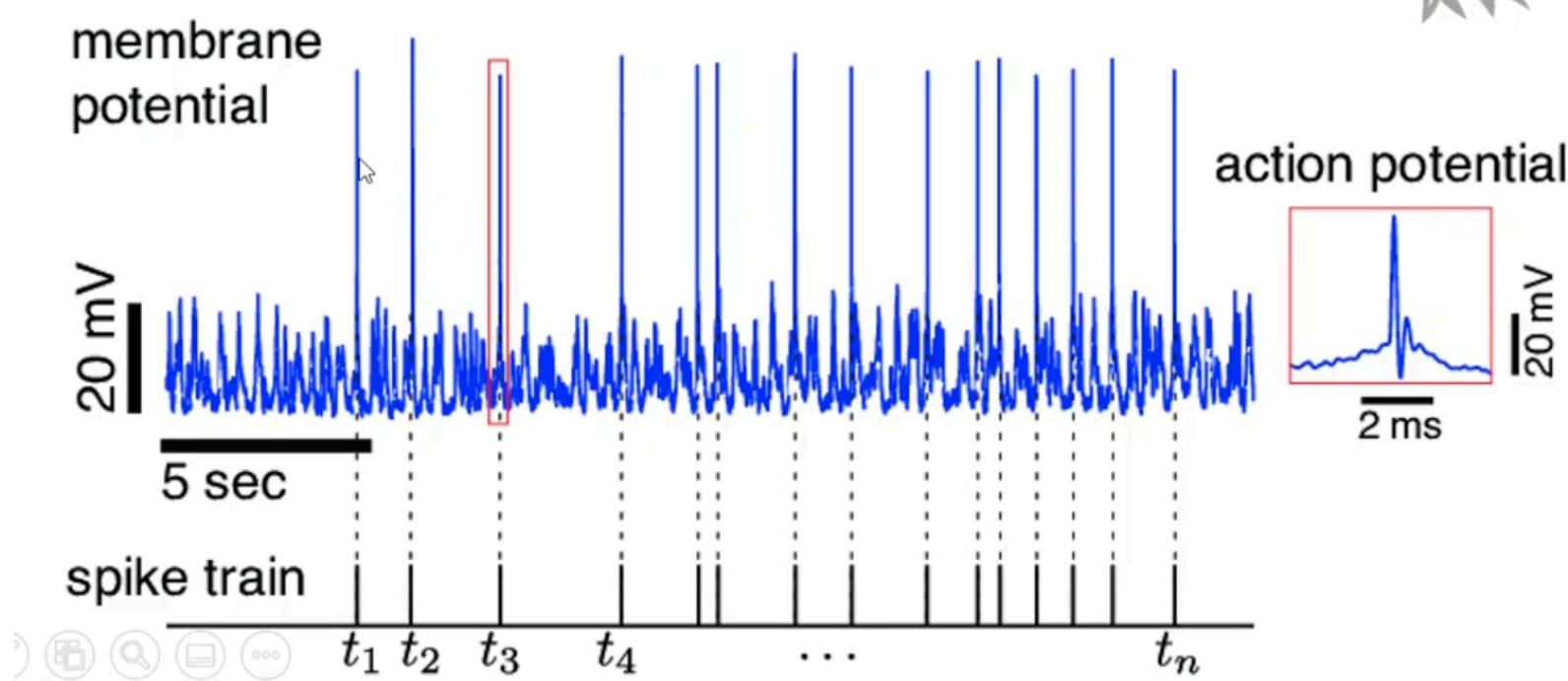
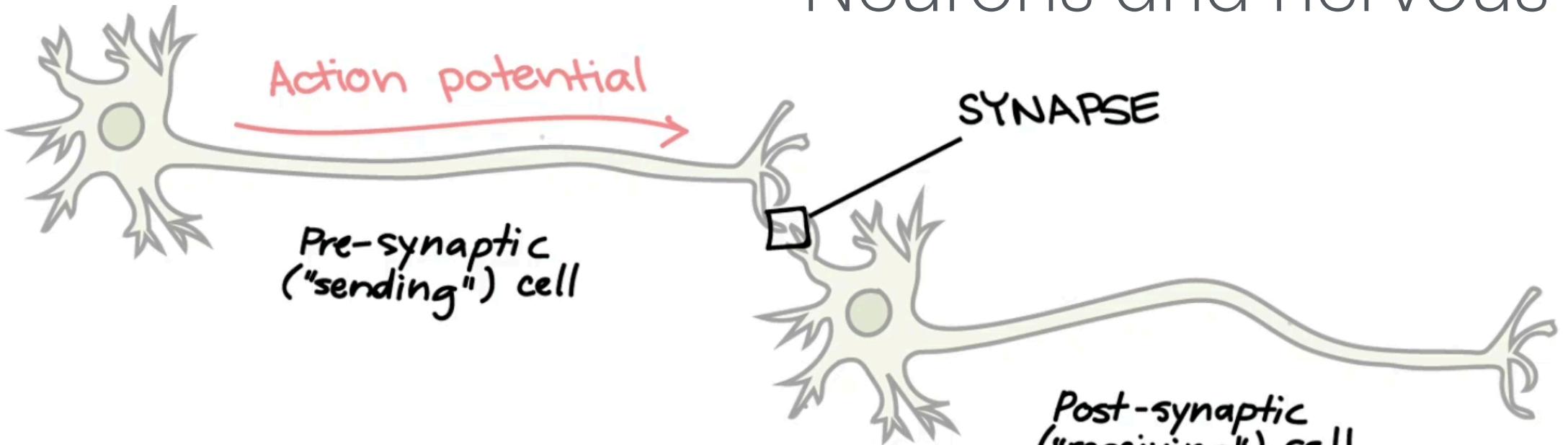


The signals and systems we study
in the NeuroEngineering Lab

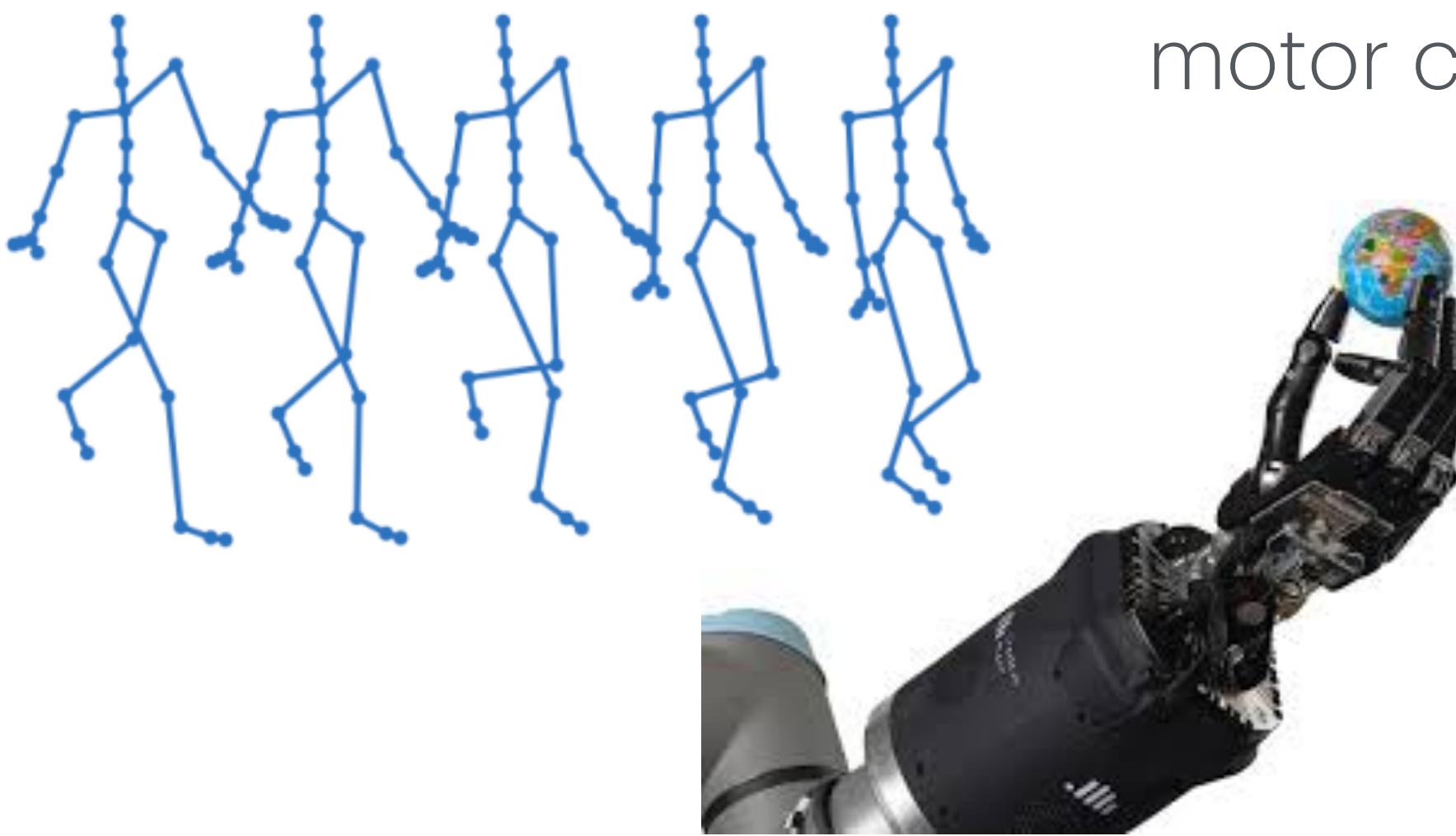
Neuromorphic systems



Neurons and nervous systems



Natural and robotic
motor control



Spiking neural networks

