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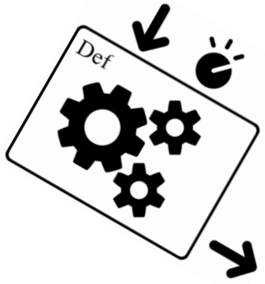
Google



Keith Quille , Karen Nolan & Roisin Faherty

Modelling

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Google Educator Grant:

Google

#EduGrants #GrowWithGoogle @GoogleEurope

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@kquille

www.CSinc.ie

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HOME ABOUT US OUTREACH CAMPS TEACHER PD RESEARCH CONTACT US

CSinc Professional Development

To compliment the CSinc outreach camps, the team also deliver Professional Development (PD), to help teachers to build confidence and to continue to build upon and deliver computer science subjects (formal and informal) within their schools.

The teacher professional development has been very successful, where the CSinc team delivered PD to ~800 teachers (some repeated sessions), with the demand to run multiple sessions around the country over the past two years. We travelled to several schools, where the school hosted the PD session, and also ran PD in four education centers. The demand is again growing with teachers/groups calling for additional sessions around the country, if you wish to host a PD session in your school as a group or cluster, please contact us.

The PD sessions vary in content, from introductory microbit (primary school and up), up to and including the leaving certificate computer science subject. Below you will find all of our formal sessions. We also run sessions in local schools (from Donegal to Cork), which will not be listed below, so contact us, if you are unable to attend some of the formal sessions, and we may be able to point you to some of our outreach PD sessions.

With the kind support of Google (under the Educator Grants program) and Microsoft Ireland, we invite you to attend any of our PD sessions!

Microsoft Google

Professional Development Resources

Many of these resources are from the NCCA for the Leaving Certificate Computer Science subject, where one of the CSinc team members was commissioned to develop them. We have also many other resources to share, contact us to enquire about the resources for Junior Cycle short course!

> NCCA: Leaving Certificate Computer Science Specification (Available here)

> NCCA: Leaving Certificate Computer Science Python Video Tutorials (Available here)

> NCCA: Leaving Certificate Computer Science Micro:bit Video Tutorials (ALT4) (Available here)

> NCCA: Leaving Certificate Computer Science ALT1 Interactive Information Systems Video Tutorials (Available here)

> Compsci.ie - an amazing collection of resources developed by the PDST and teachers alike (Available here)

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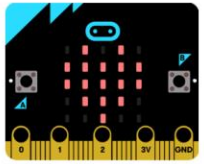
September 2019



Introduction to the Micro:bit

10/09/2019 Venue: Sligo Education Center

An introduction to the BBC Micro:bit (for complete novices! Primary to second level)

HTML, CSS and Intro to JavaScript

14/09/2019 Venue: TU Dublin Talaght Campus (10am to 3pm)

Aimed at Junior Cycle Short course and the Leaving Certificate Computer Science Subject (Introductory)

Interactive Web Systems and Cloud Databases - ALT1

21/09/2019 Venue: TU Dublin Tallaght Campus (10am to 3pm)

For the leaving certificate computer science subject, Applied Learning Task 1 using JavaScript and Google Firebase(come along if you just want to see what it is all about!)

HOME ABOUT US OUTREACH CAMPS TEACHER PD RESEARCH CONTACT US

Welcome to our outreach camps!

CSinc developed the camps to be mobile to travel to the schools all over Ireland. This way your school do not need a functioning computer room , just a regular room where we can run the camps using our laptops and equipment. Over the past two years of outreach camps, this has suited schools as it cut down cost on teacher cover and transport to get the students to TU Dublin, as some schools have been located as far as Donegal, Mayo and Cork! allowing for the amazing uptake in the camps which was not expected, which we believe is down to our unique

In addition, we usually run several camps in the one day. That is, if we travel to your school, and we run our introductory two-hour camp, we can usually run three a day (depending on the location of the school for travel time), for example from 9-11, 11:10 to 1:10 and 2-4pm. Since 2017 we have reached over 260 schools and the schools really liked this format, as it was minimal disruption to the school day.

The camp (for primary, secondary level) usually consisted of an introduction, which aimed to highlight stereo types and address them, for example the low gender uptake, or the requirement to be a maths genius. This is followed by an introduction to code using a Micro:bit, creating projects such as an emotion display for autistic students and a fit-bit. The camp is concluded with a session on computational thinking using the Bebras challenge.

Outreach Promotional Video

<Computing Camps/>

Camp bookings

Thank you so much for your support, we are fully booked out for the 2019 and 2020 academic year.

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CSinc Research Group

With the amazing support of the outreach programme from schools, and the uptake in teacher PD sessions, the CSinc team are conducting longitudinal research to improve the CSinc approaches.

Students and teachers have been participating in surveys (during outreach camps and teacher PD), where last year the team collected 2500 surveys. This is vital in the CSinc dvelopment. This research will inform the team on pedogicial development, content and activity development and perhaps most importantly will help the CSinc team reach and inform students, of what Computer Science really is, addressing streotypes and incorrect perceptions of the subject.

Below are some the publications from team members, while not all of it is directly related to CSinc, they are relevant to introductory computer science..

The research group spans three academic instituions. The group is always looking for new members, from PhD students to academic members. Please contact us for further details.

The Research Group:

Keith Quille - TU Dublin
Karen Nolan - TU Dublin
Roisin Faherty - TU Dublin
Brett Becker - UCD
Susan Bergin - Maynooth University

Publications

Conferences

50 Years of CS1 at SIGCSE: A Review of the Evolution of Introductory Programming Education Research. Proceedings of the 50th ACM Technical Symposium on Computer Science Education (SIGCSE 2019), Minneapolis, Minnesota, USA, February 2019. ACM.

Second Level Computer Science: The Irish K-12 Journey Begins. Proceedings of the 18th Koli Calling International Conference on Computing Education Research (Koli Calling '18) ACM, Koli, Finland, 2018.

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do your :bit

A micro:bit digital challenge for the Global Goals

A new BBC micro:bit challenge for children and teens to combine creativity and technology in solutions for the Global Goals.

Co-creators

micro:bit | arm | WORLD'S LARGEST LESSON

In partnership with unicef

@microbit_edu

Session Overview:

Learning Outcomes

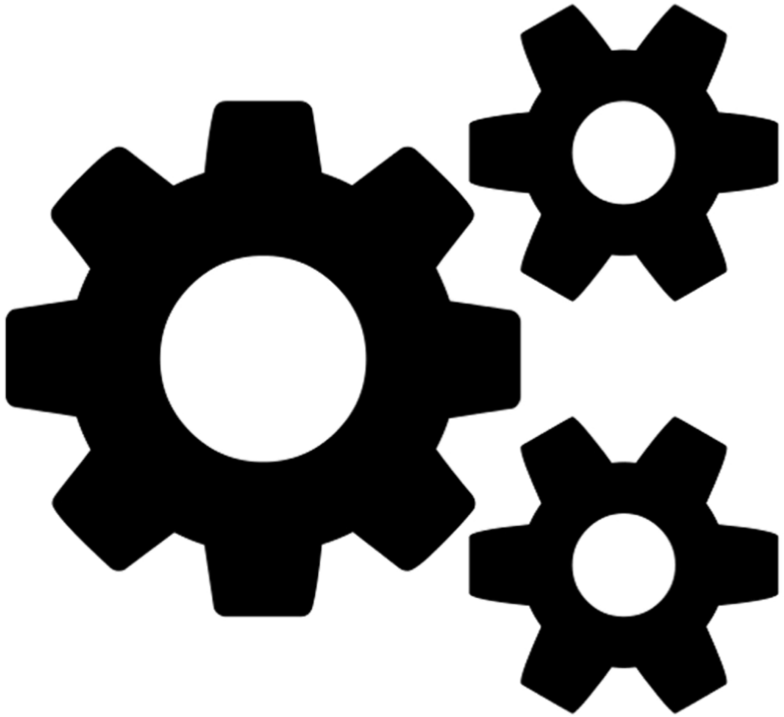
○ Modelling using Algorithms to test different scenarios	3.8
○ (analyse and interpret the outcome of simulations **both before and after modifications have been made**)	3.9
○ Machine Learning and Artificial Intelligence	1.14
○ Agent Based Modelling	3.10

Models:

- Let’s have a look at a higher level overview of models
- How can we represent them in Python (or any other language)

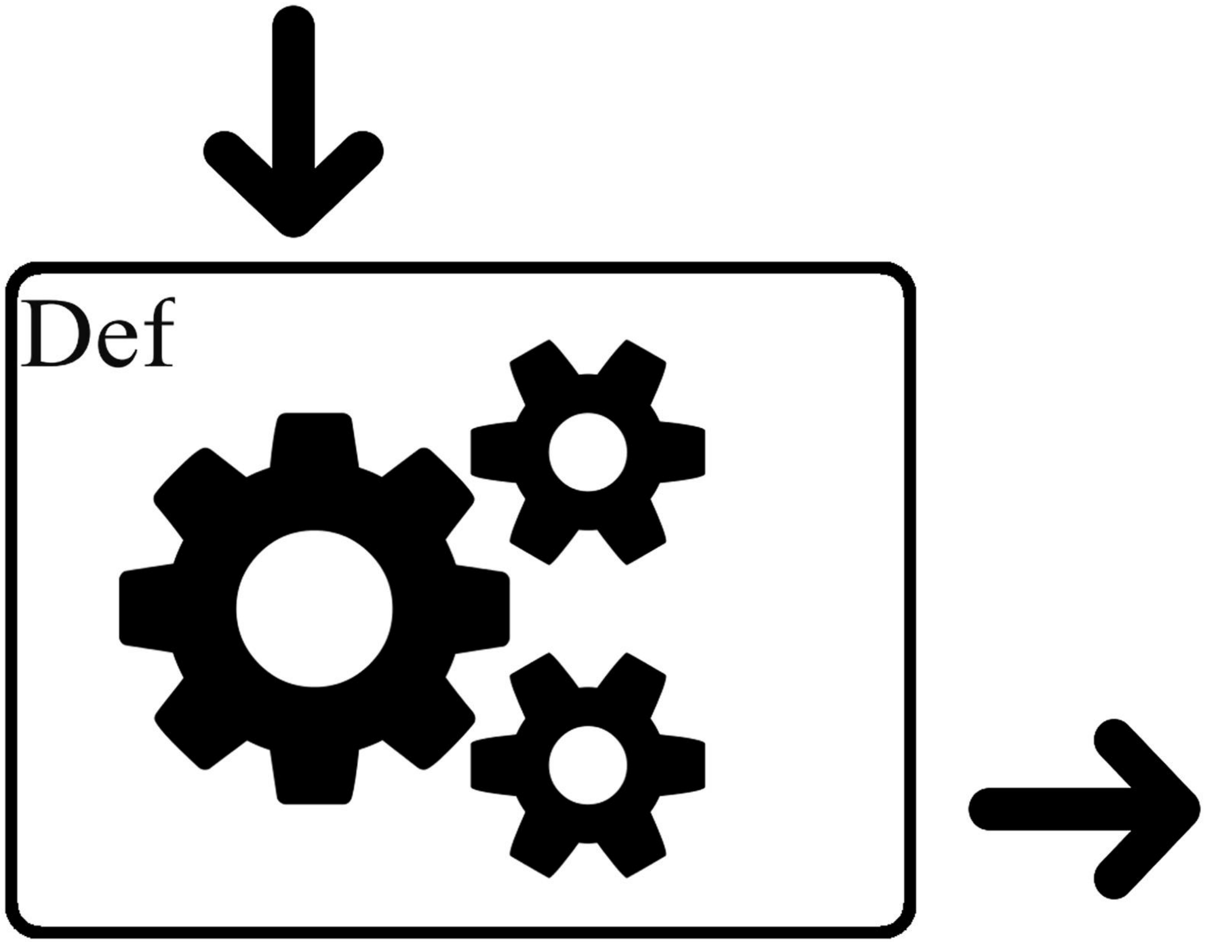
Models:

- What is a model?



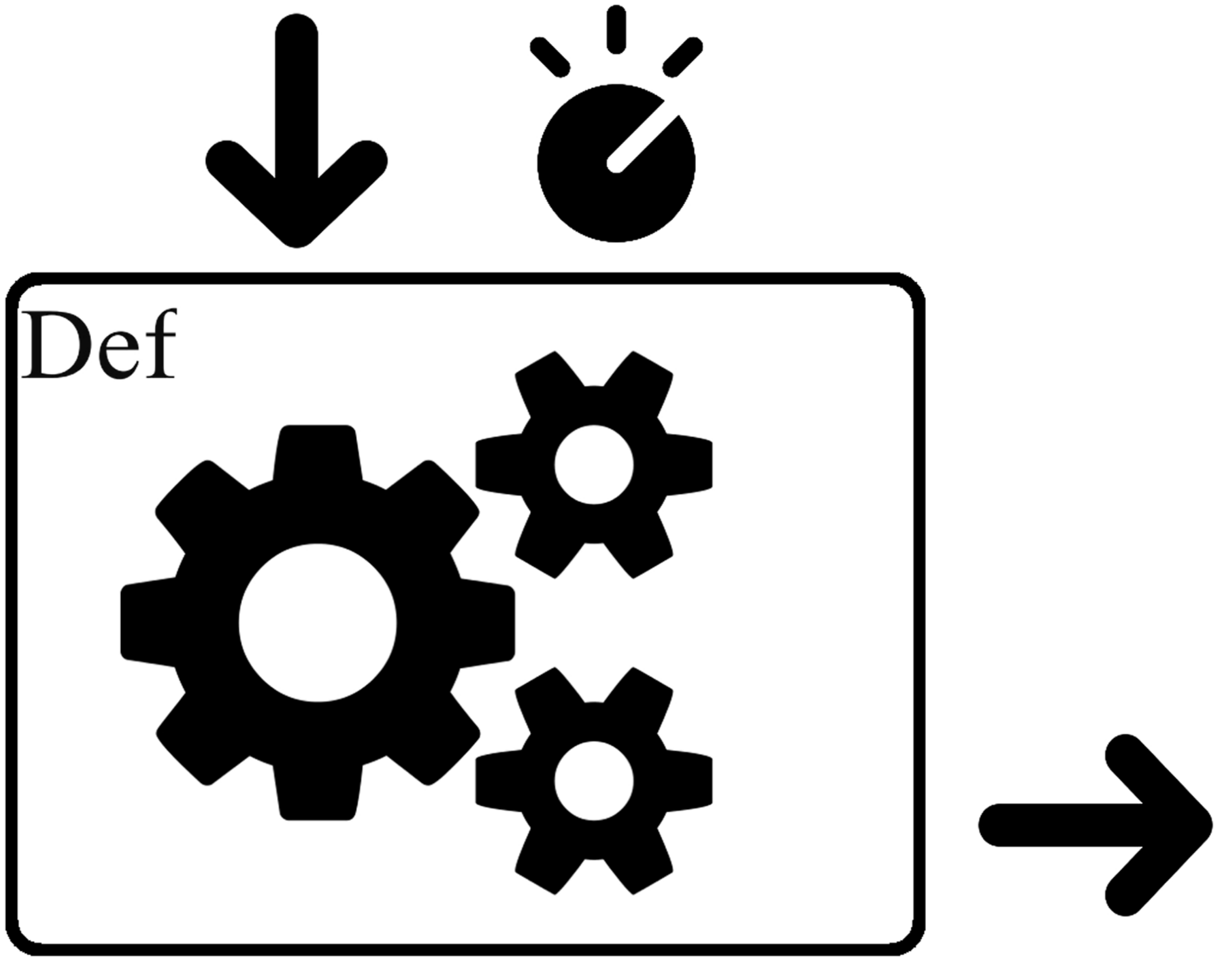
Models:

- How can we represent a model?



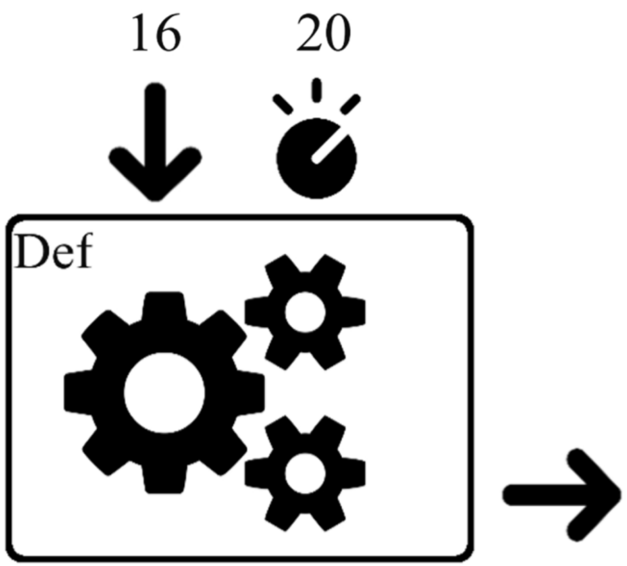
Models:

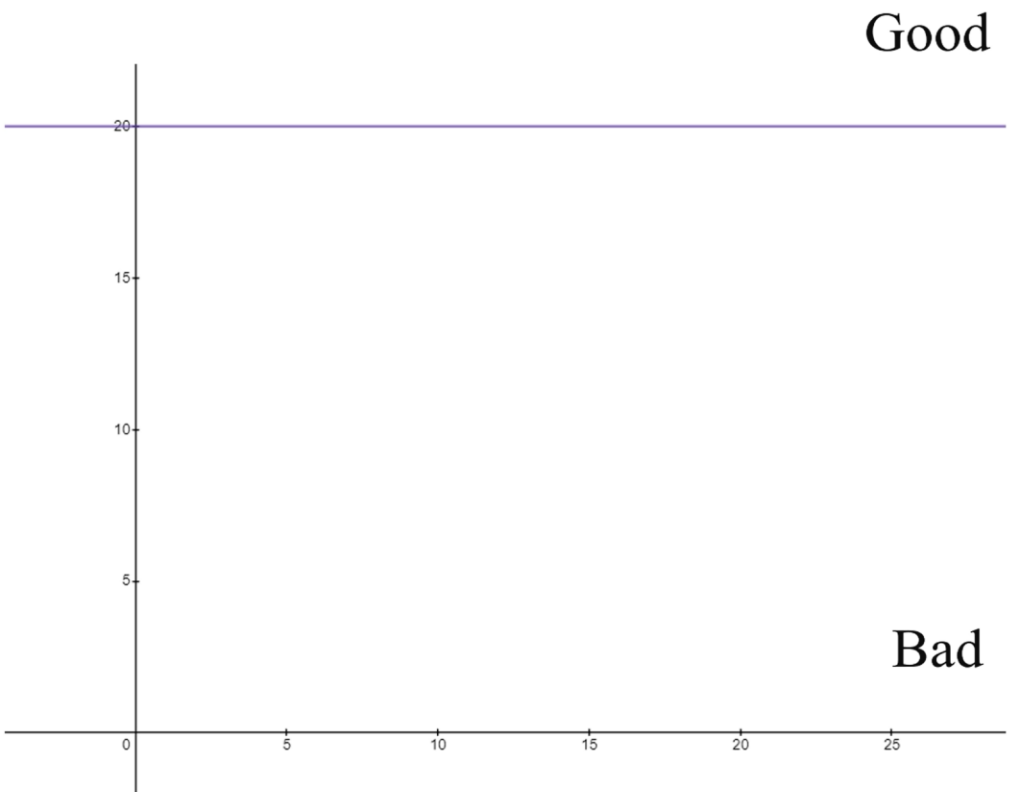
- Testing different scenarios?



Models:

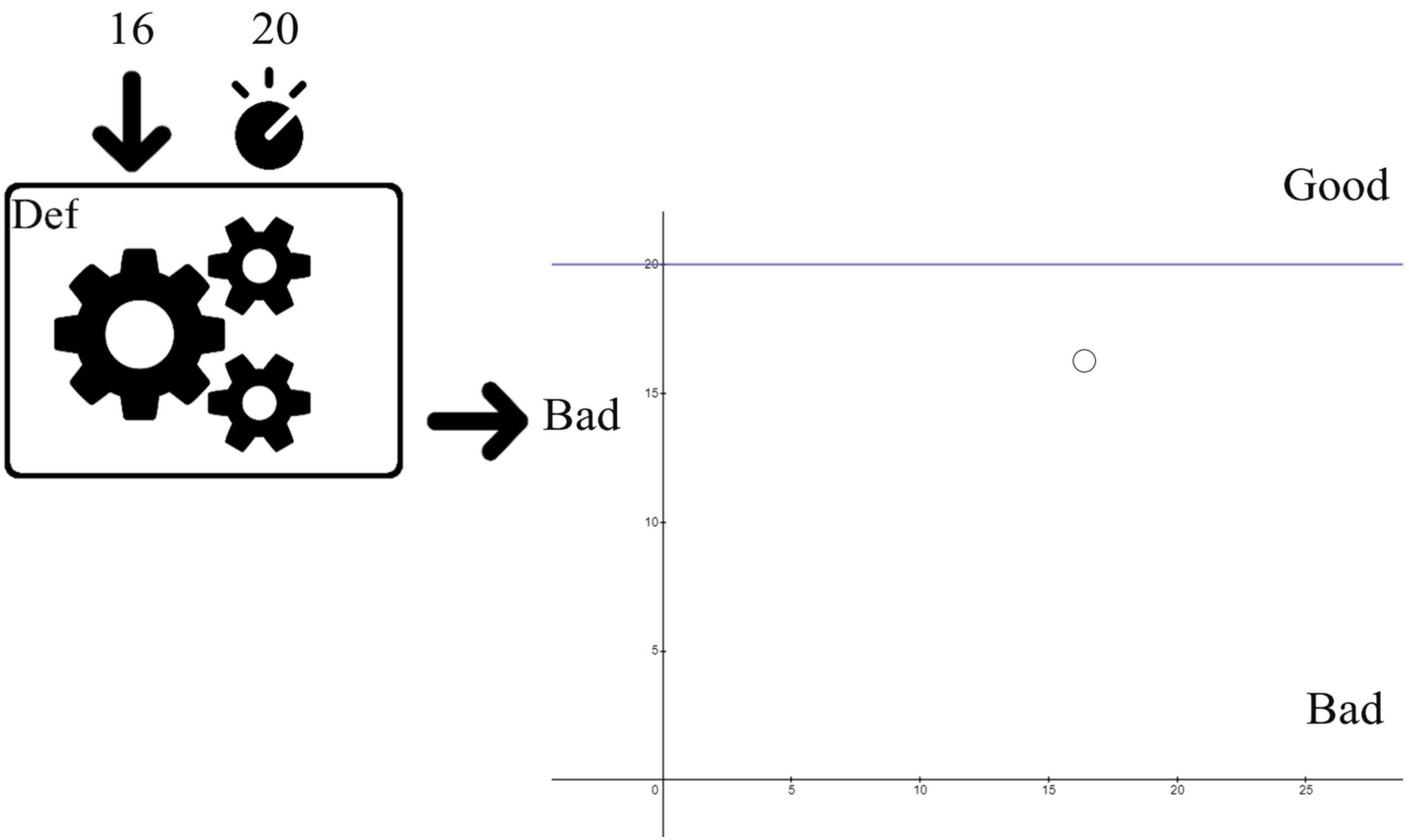
- Classify weather





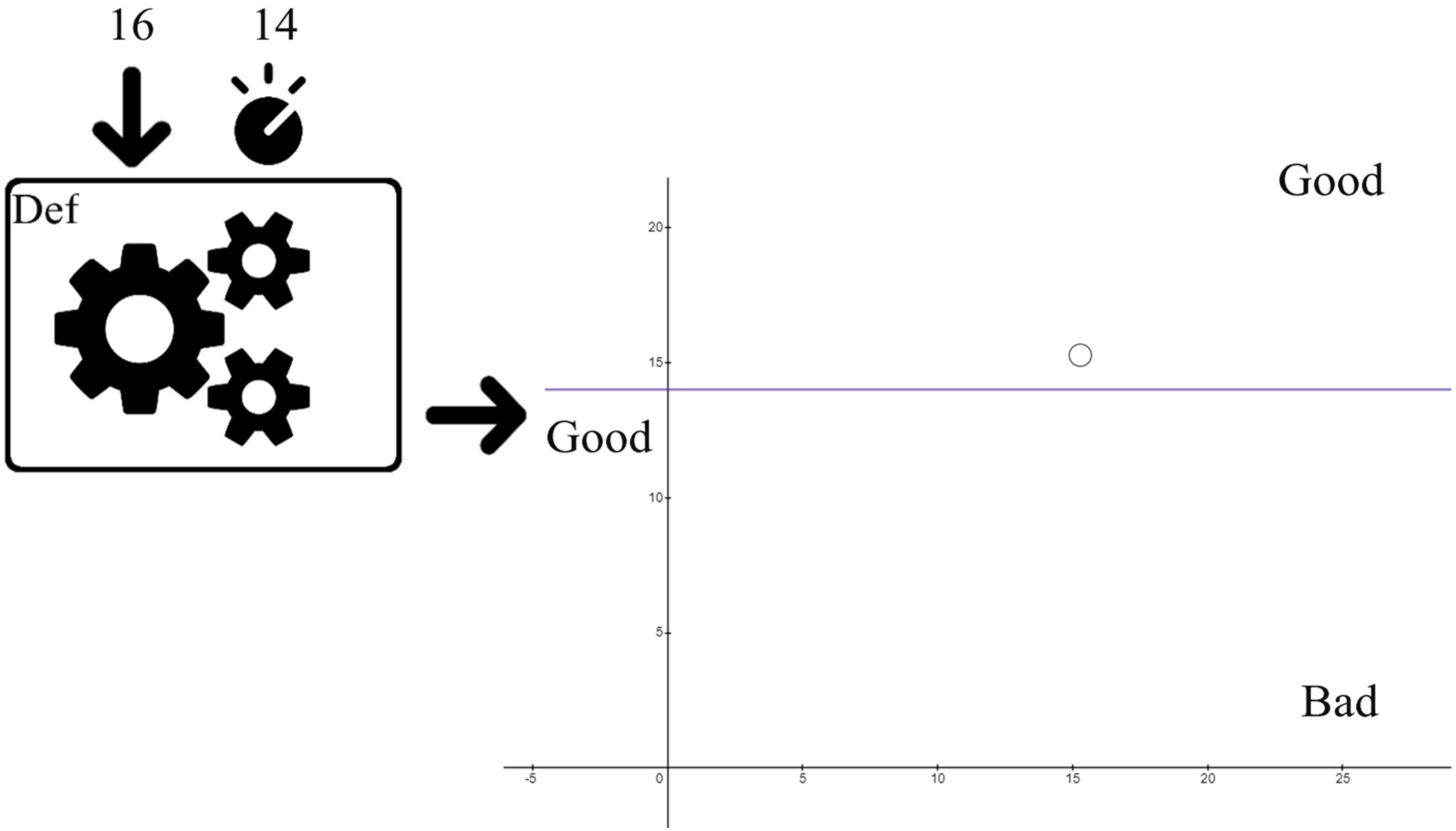
Models:

- Outcome is bad.



Models:

- Different Context like Ireland -> outcome is good

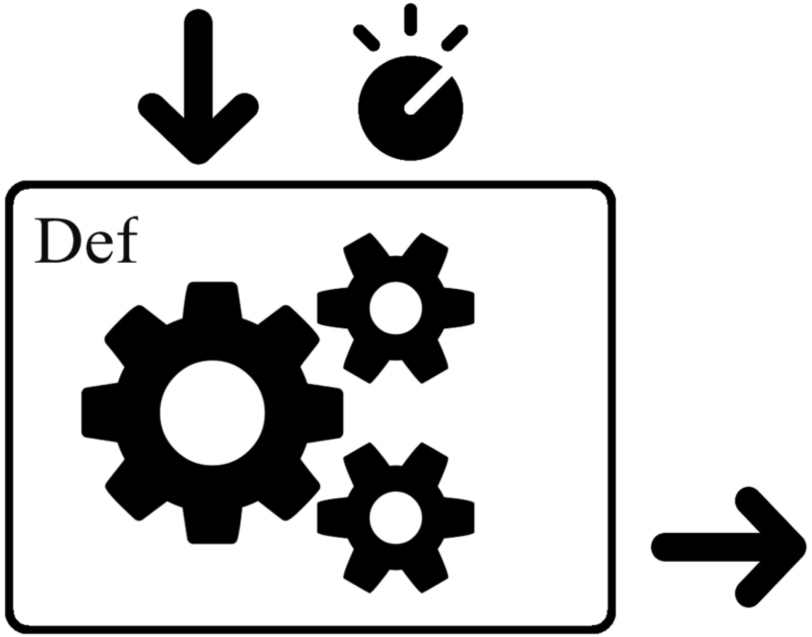


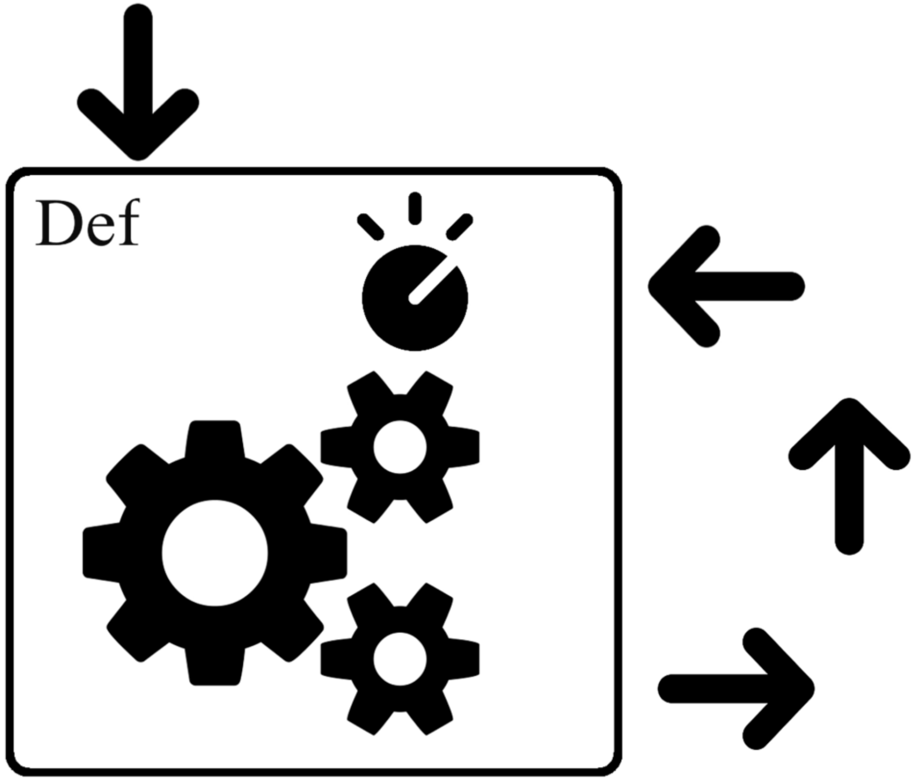
Models and Machine Learning:

Machine learning is the scientific study of algorithms and statistical models that computer systems use to perform a specific task without using explicit instructions, relying on patterns and inference instead.

Artificial intelligence is actually a subset of Machine Learning!!

Models and Machine Learning:

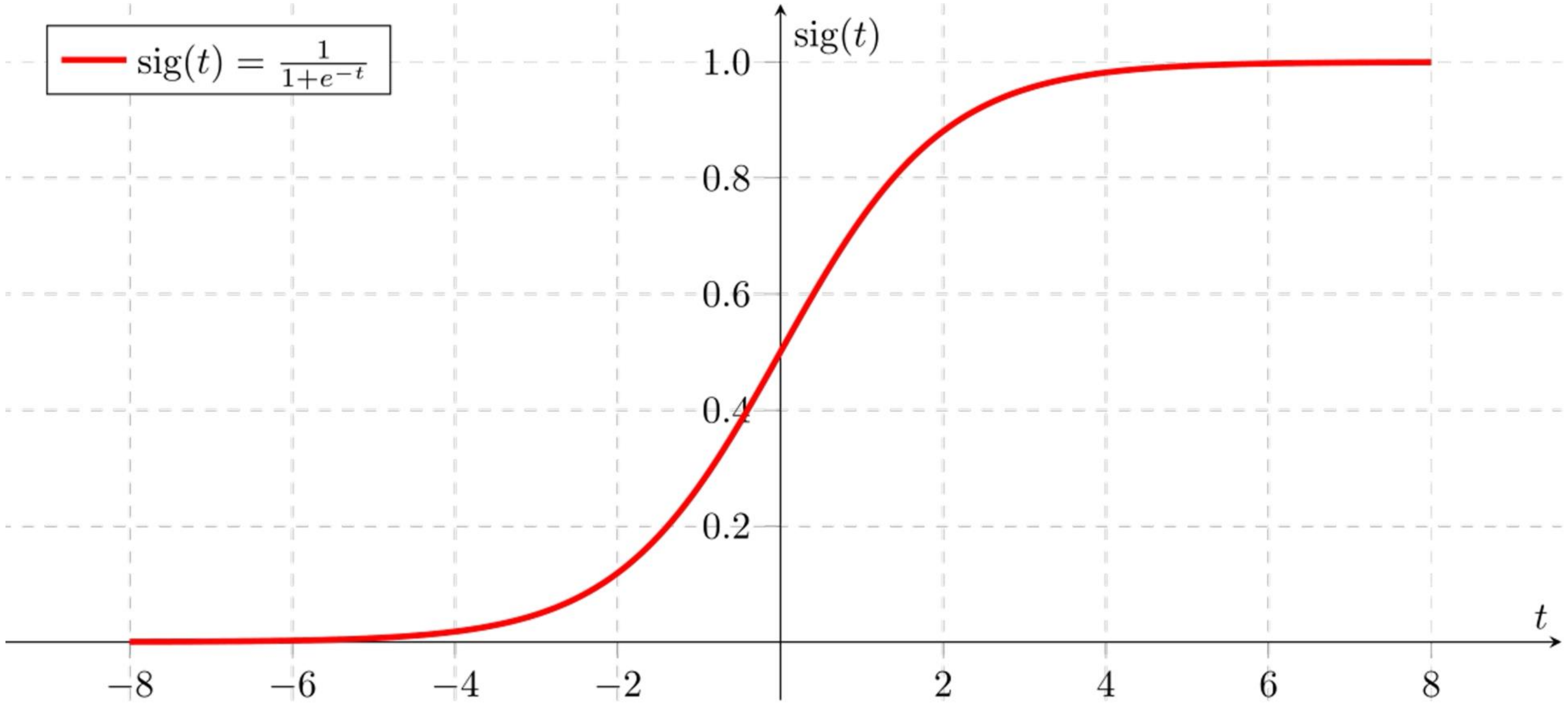




Manually trained (KNN) or “learns”

Models and Machine Learning:

- Logistic Regression



Models and Machine Learning:

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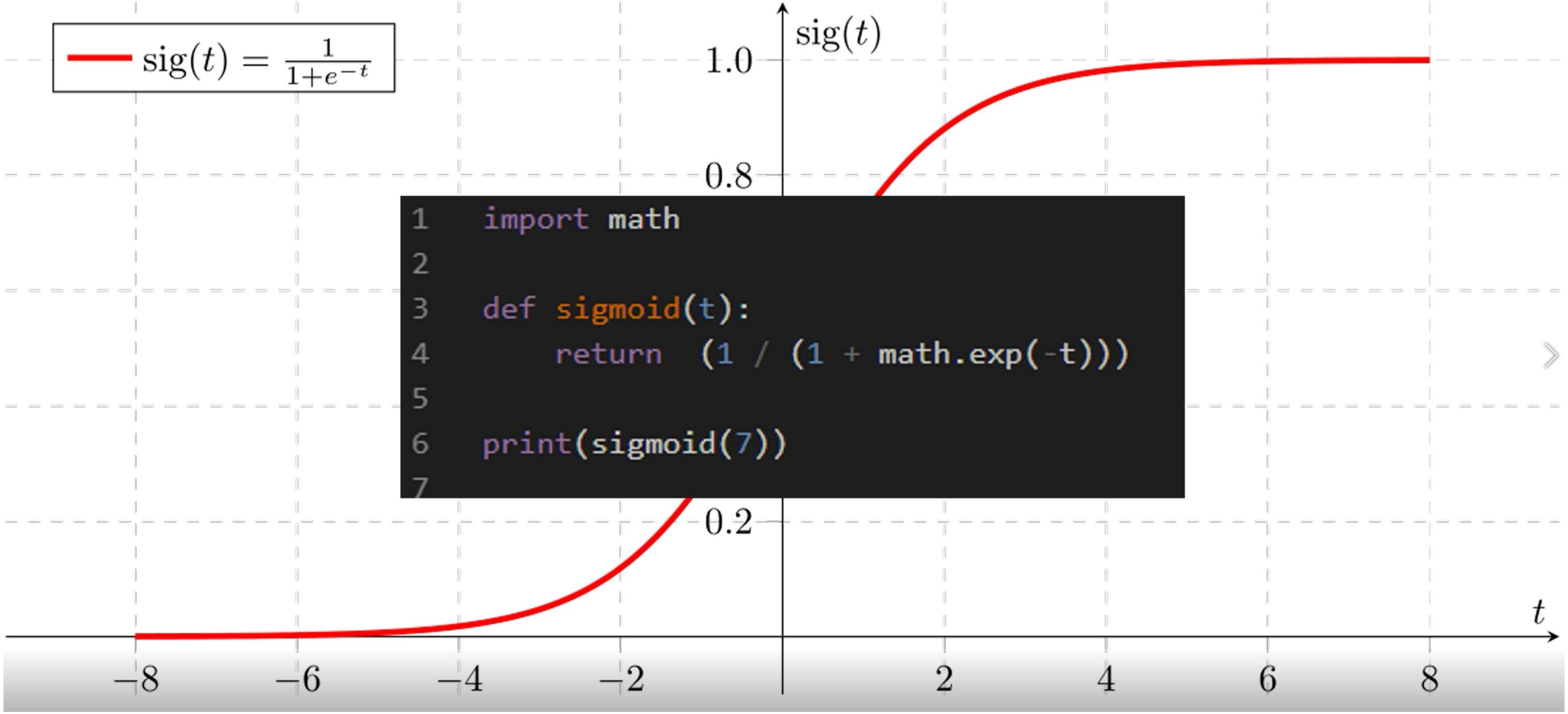
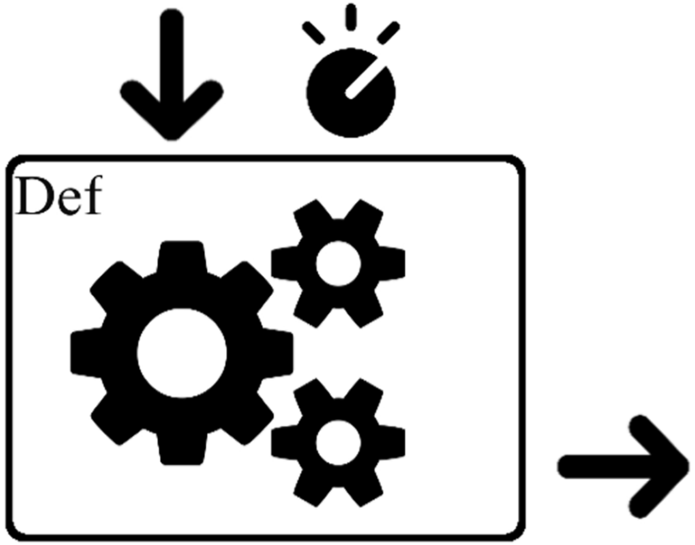


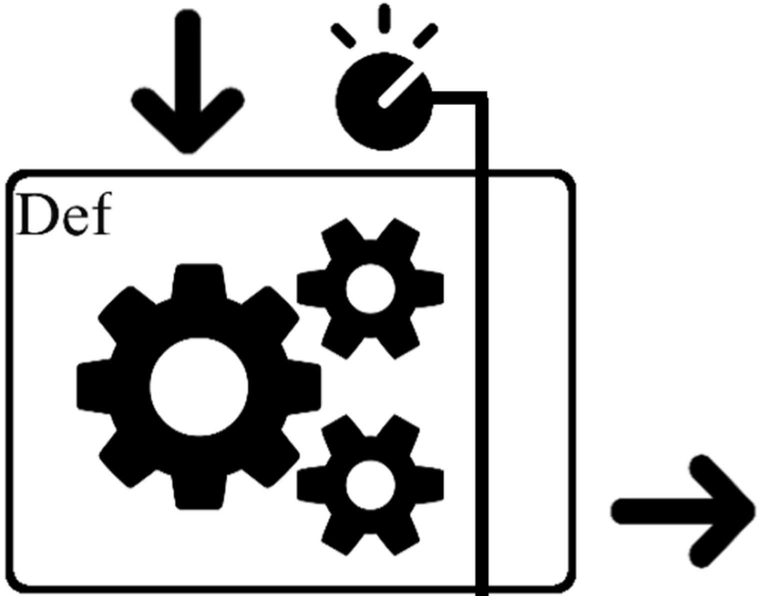

```python
import math

def sigmoid(t):
    return  (1 / (1 + math.exp(-t)))

print(sigmoid(7))
```

Models and Machine Learning:

- Learning



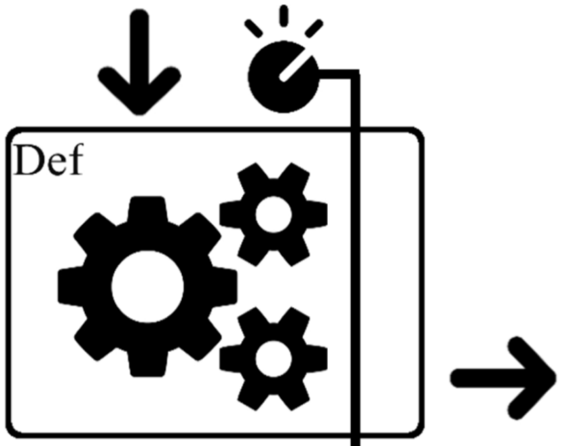
$$\frac{1}{1+e^{-(a+\beta\chi)}}$$



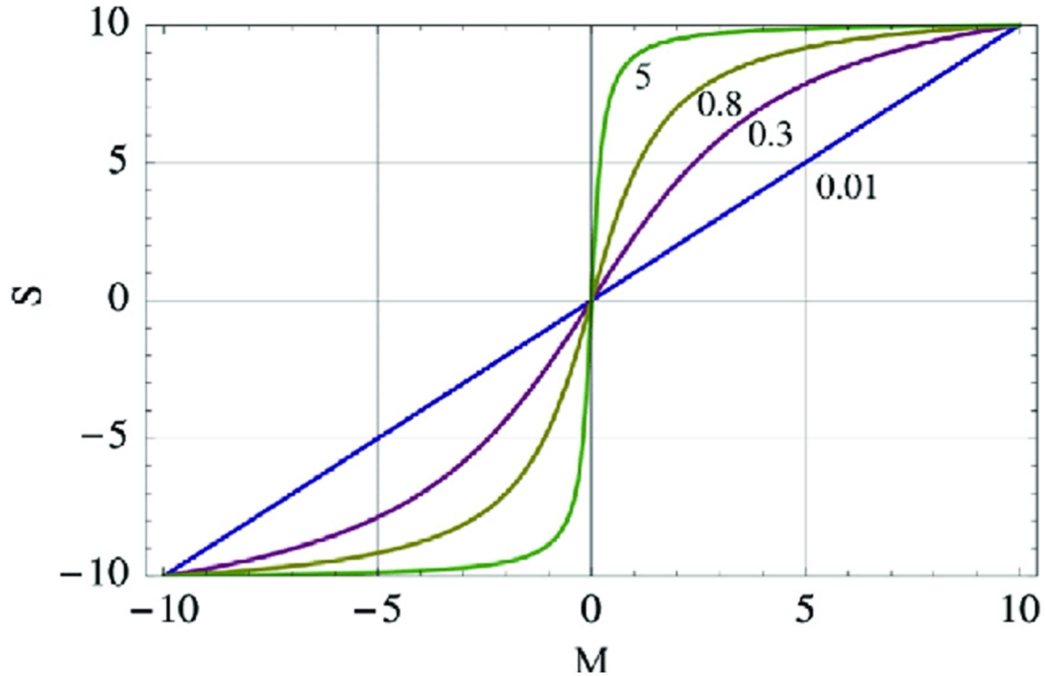
$$\frac{1}{1+e^{-(a+\beta\chi)}}$$

Models and Machine Learning:

- Learning

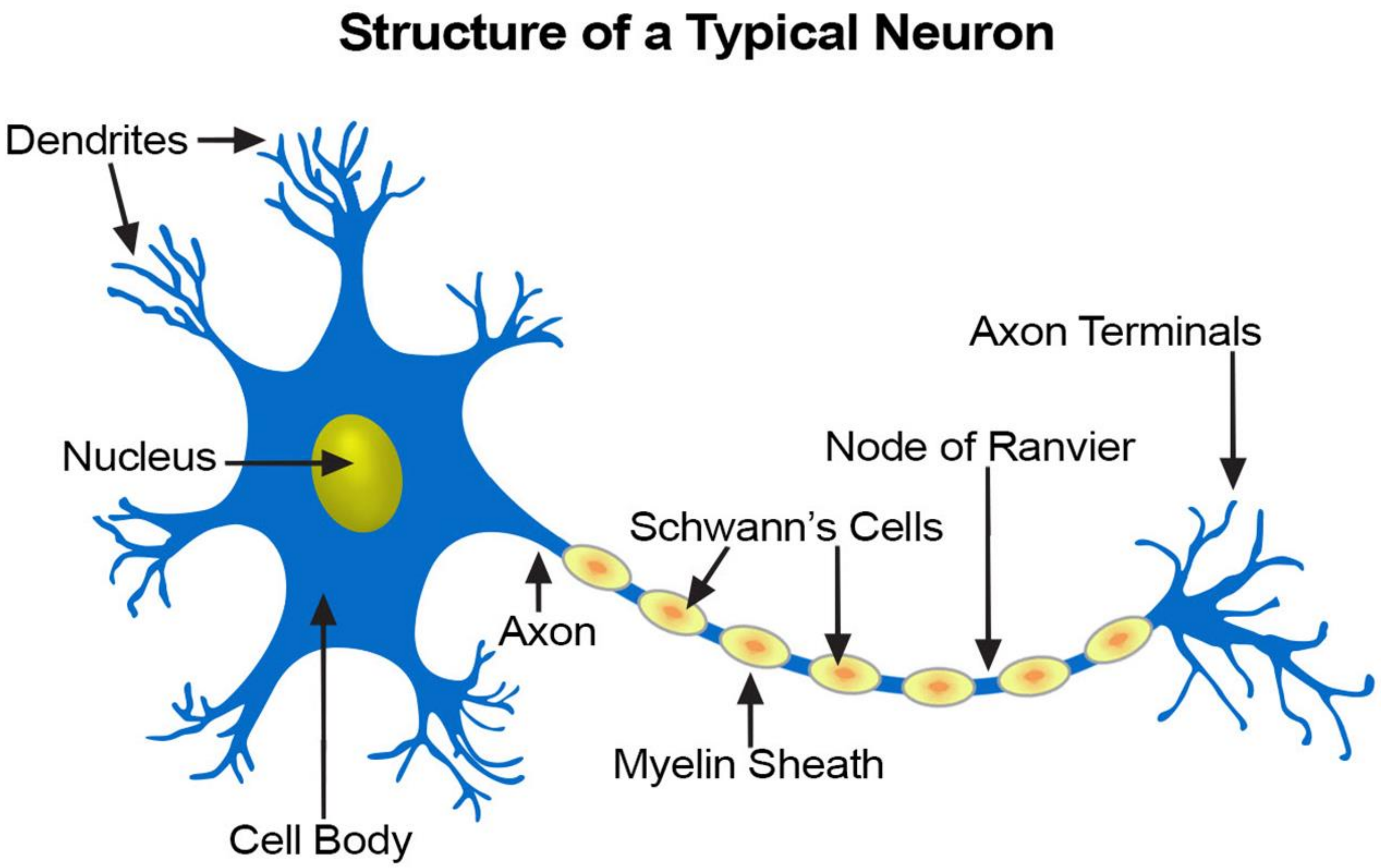


$$\frac{1}{1 + e^{-(a+\beta\chi)}}$$



Models and AI:

- What is AI?



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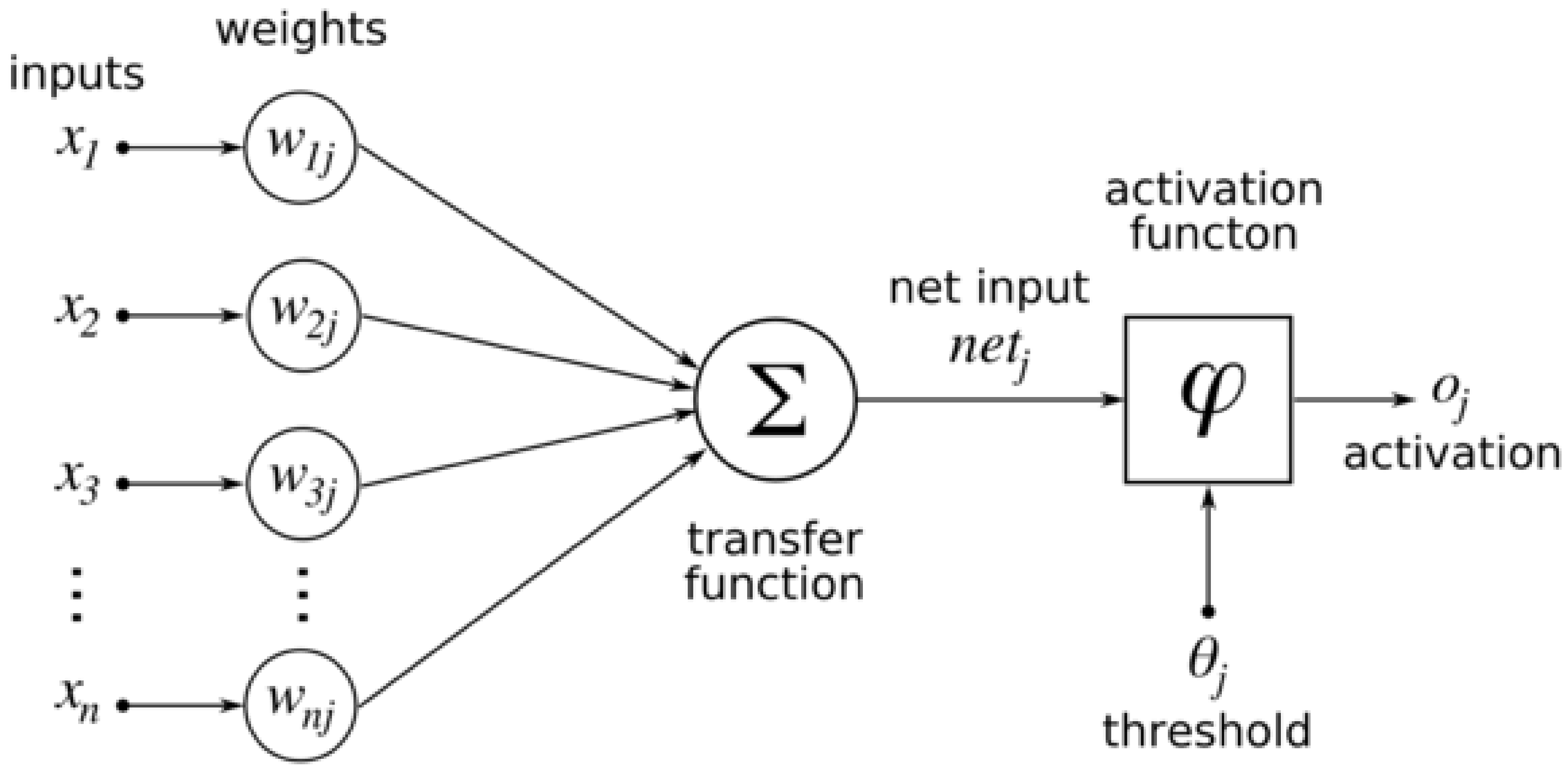

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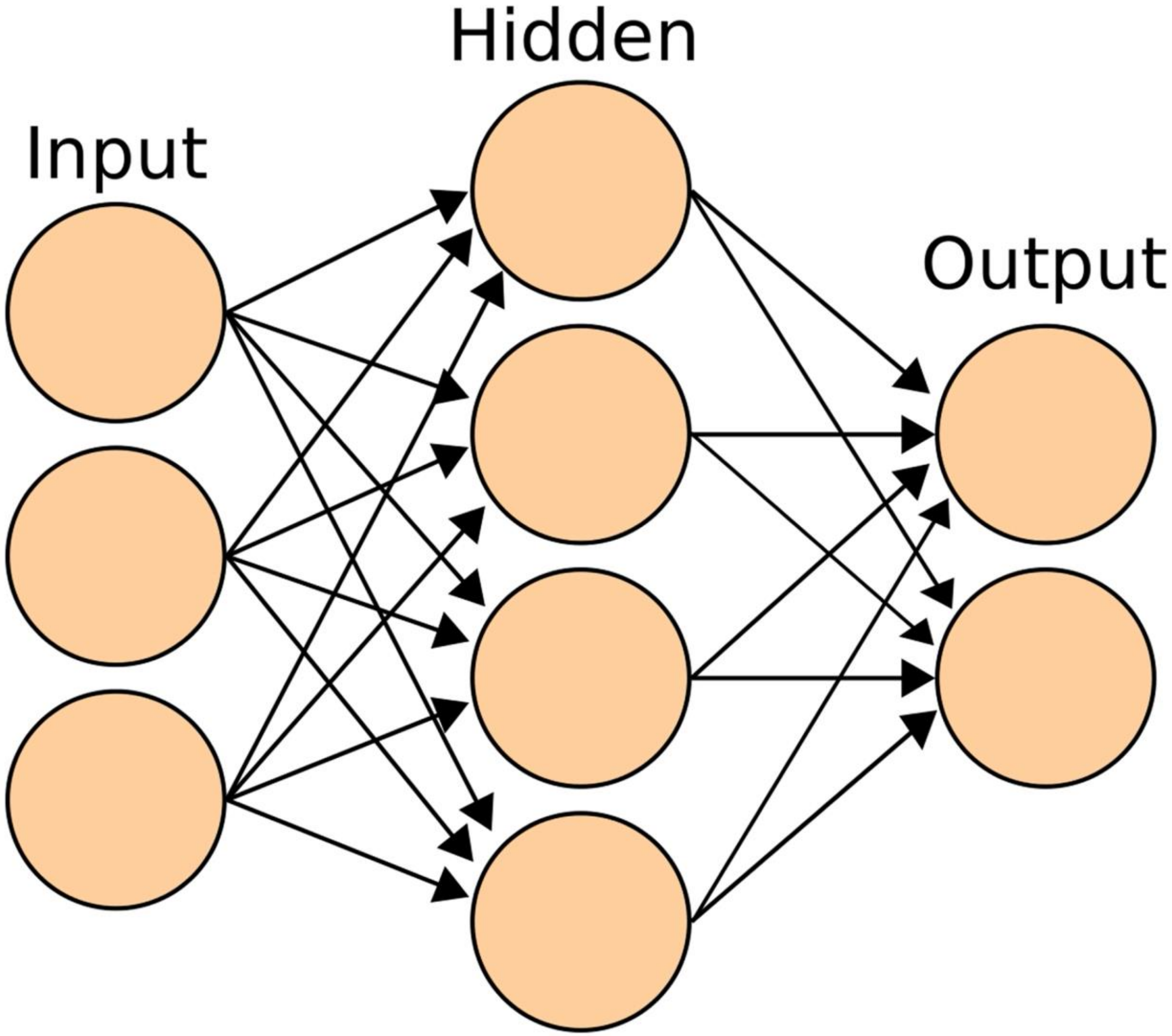
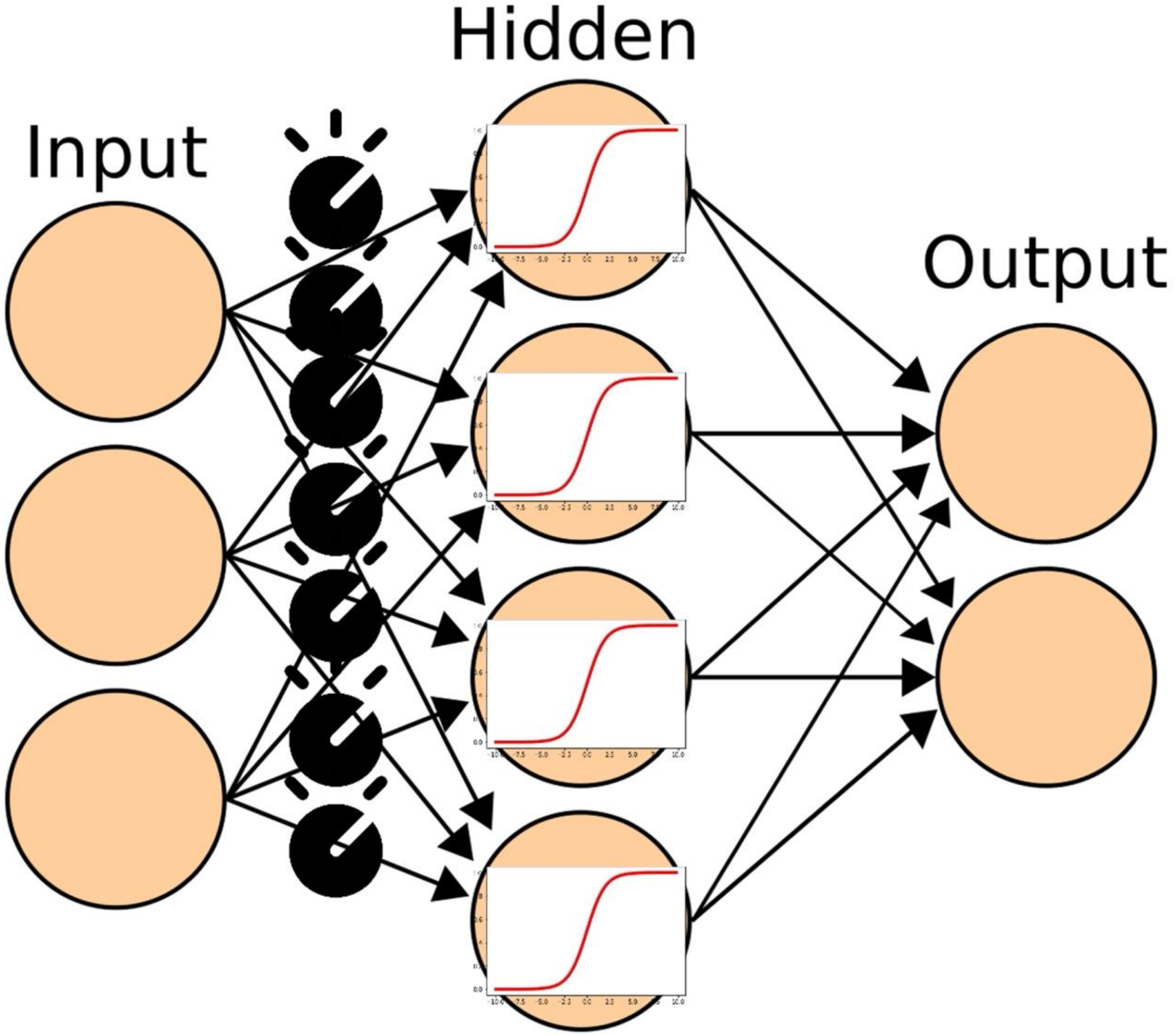


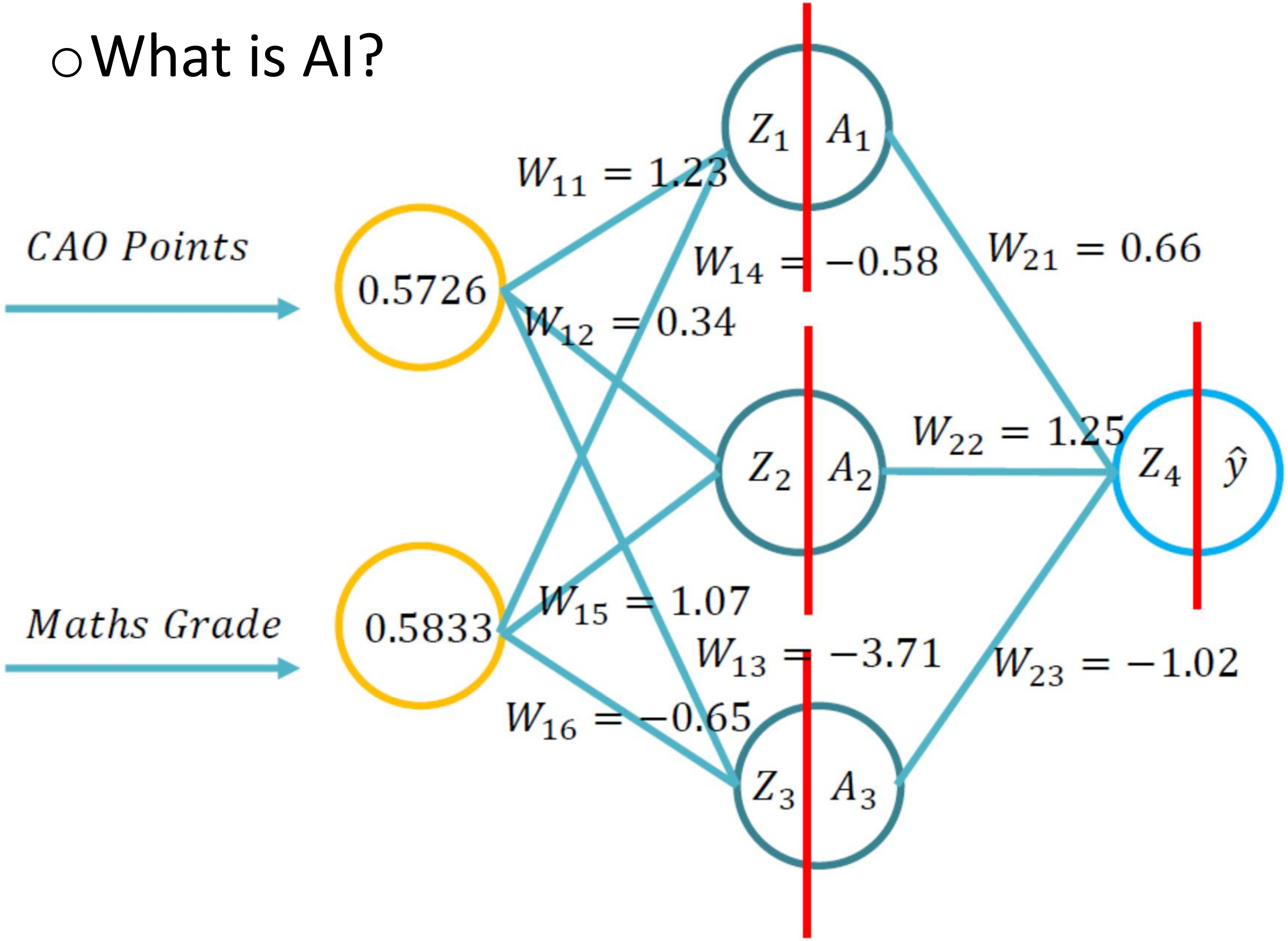
Models and AI:

- What is AI?



Models and AI:

- What is AI?



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X1 (Points)	X2 (Maths)	Y (CS1 Grade)
0.5726	0.5833	0.7500
0.4032	0.4583	0.6200
0.6774	0.6250	0.8000
0.6129	0.5000	0.7800

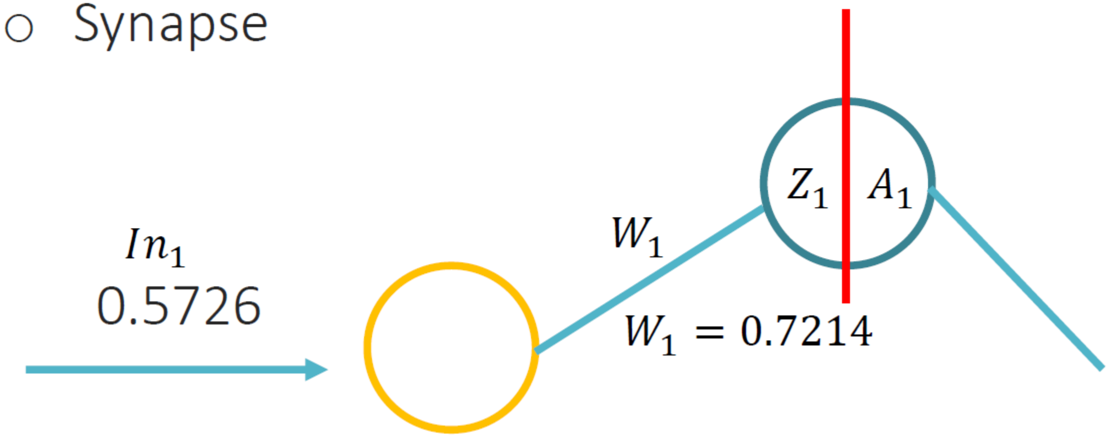
A

B

Models and AI:

○ What is AI?

- Synapse



$$Z_1 = In_1 x\ W_1$$

$$Z_1 = 0.5726\ x\ 0.7214 = 0.4131$$

$$A_1 = \frac{1}{1 + e^{-Z_1}}$$

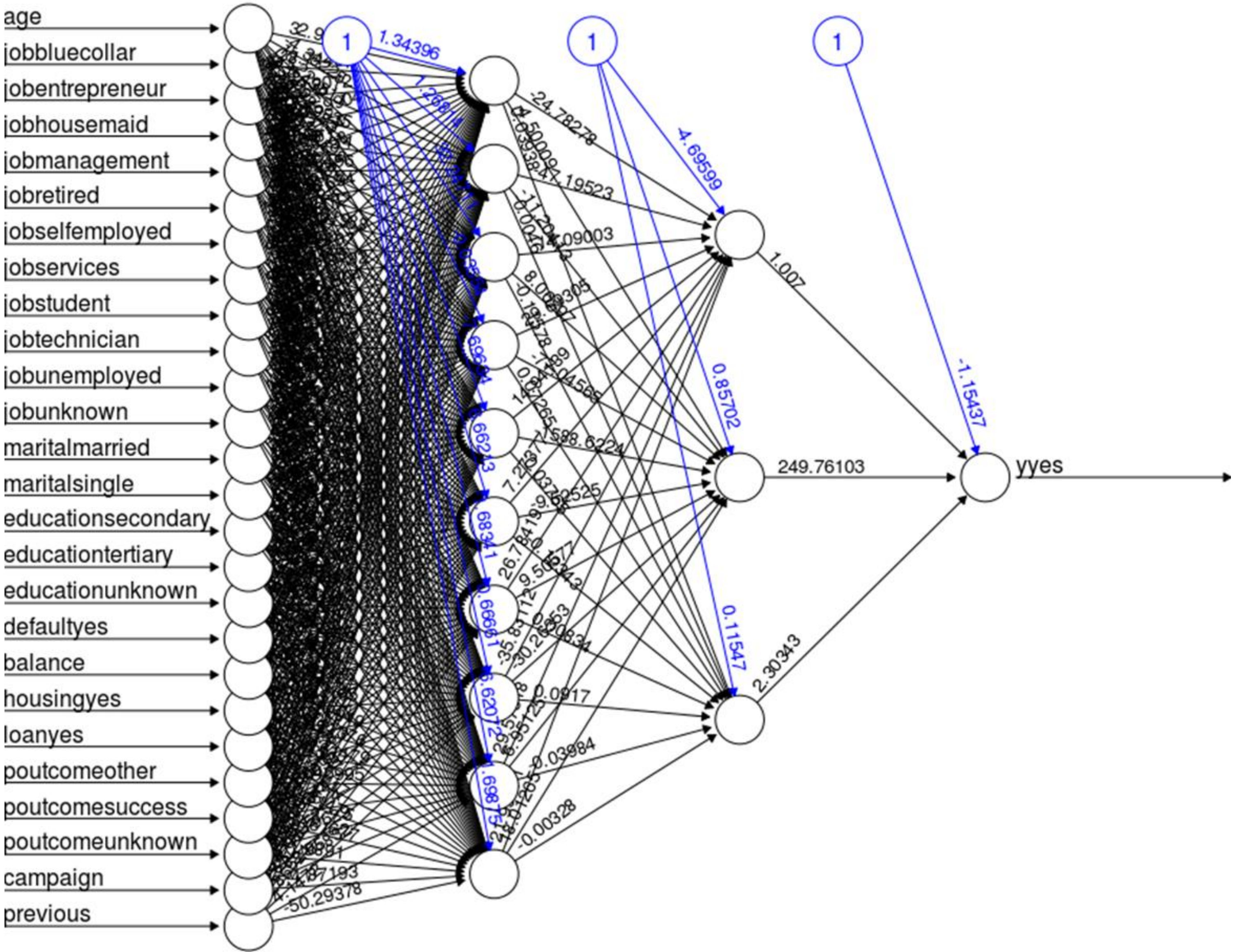
$$A_1 = \frac{1}{1 + e^{-((In_1 x\ W_{11}) + (In_2 x\ W_{14}))}}$$

$$A_1 = \frac{1}{1 + e^{-(0.4131)}}$$

$$A_1 = 0.6018$$

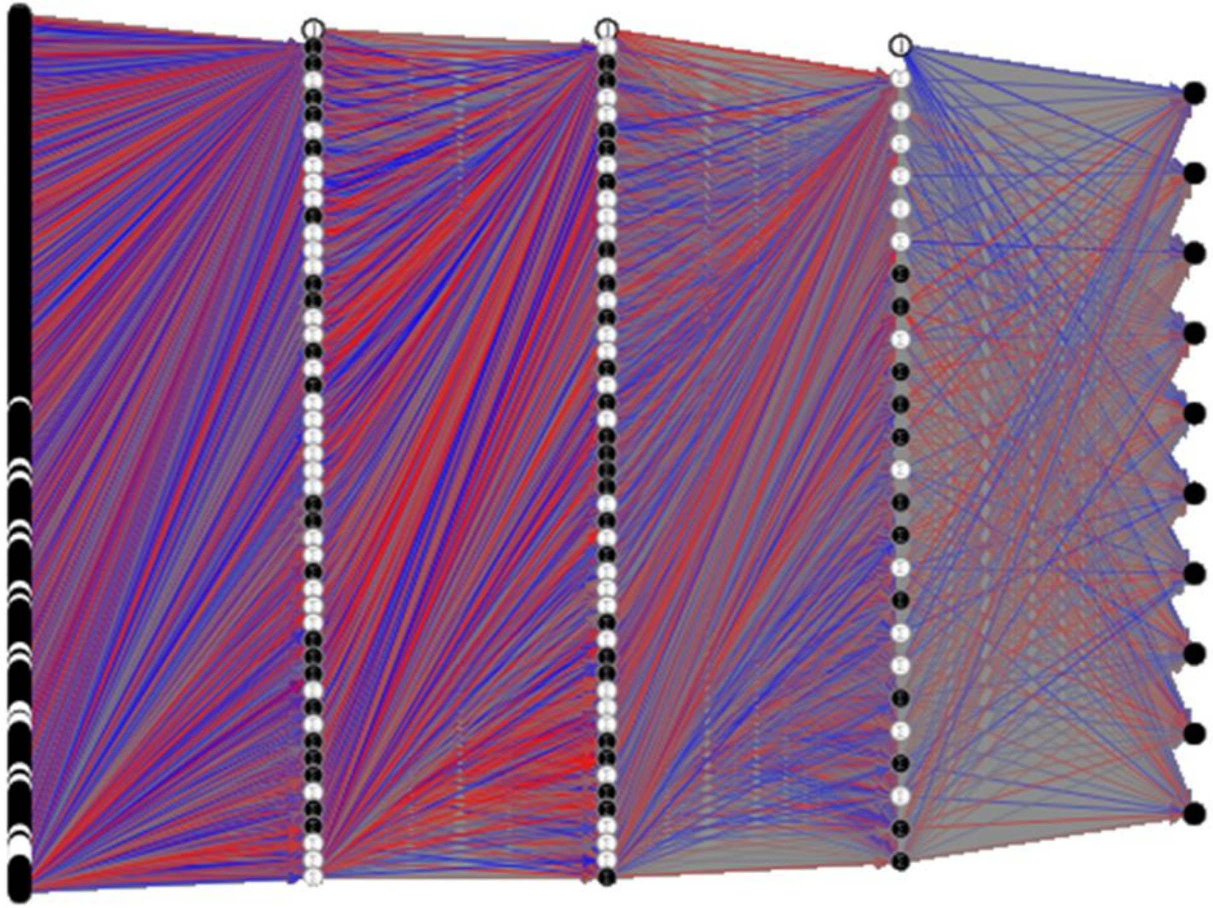
Models and AI:

- What is AI?



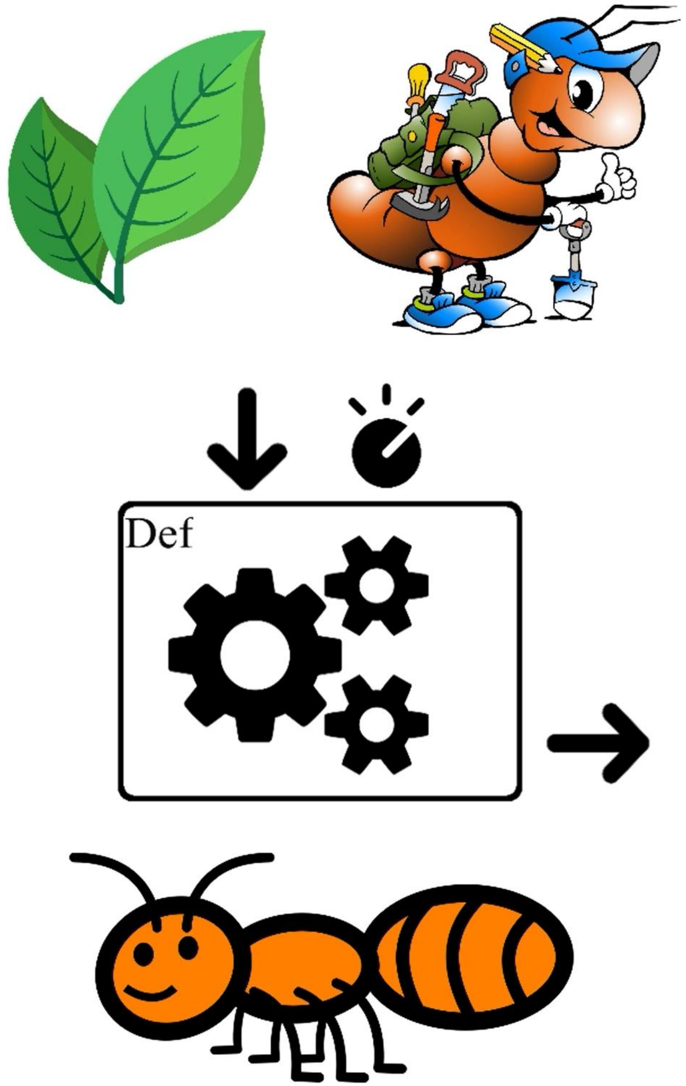
Models and AI:

- What is AI?



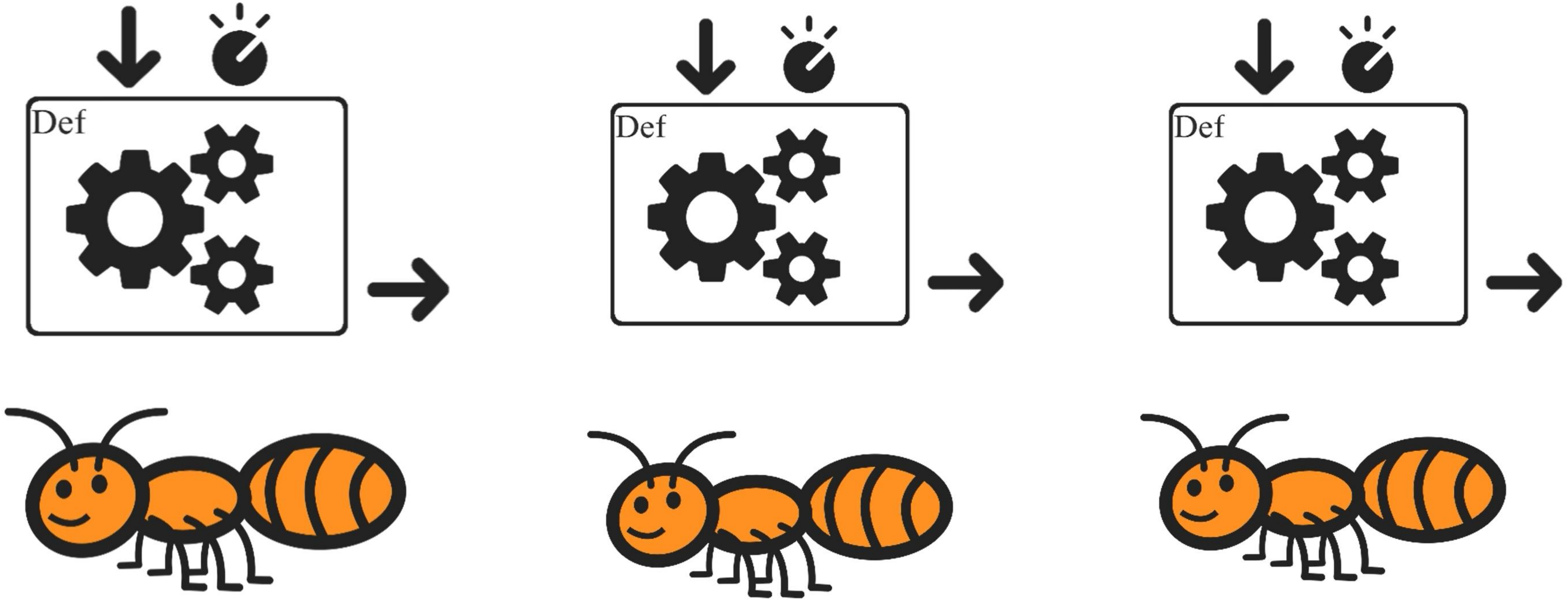
Models Agent Based Modelling:

- Ants…



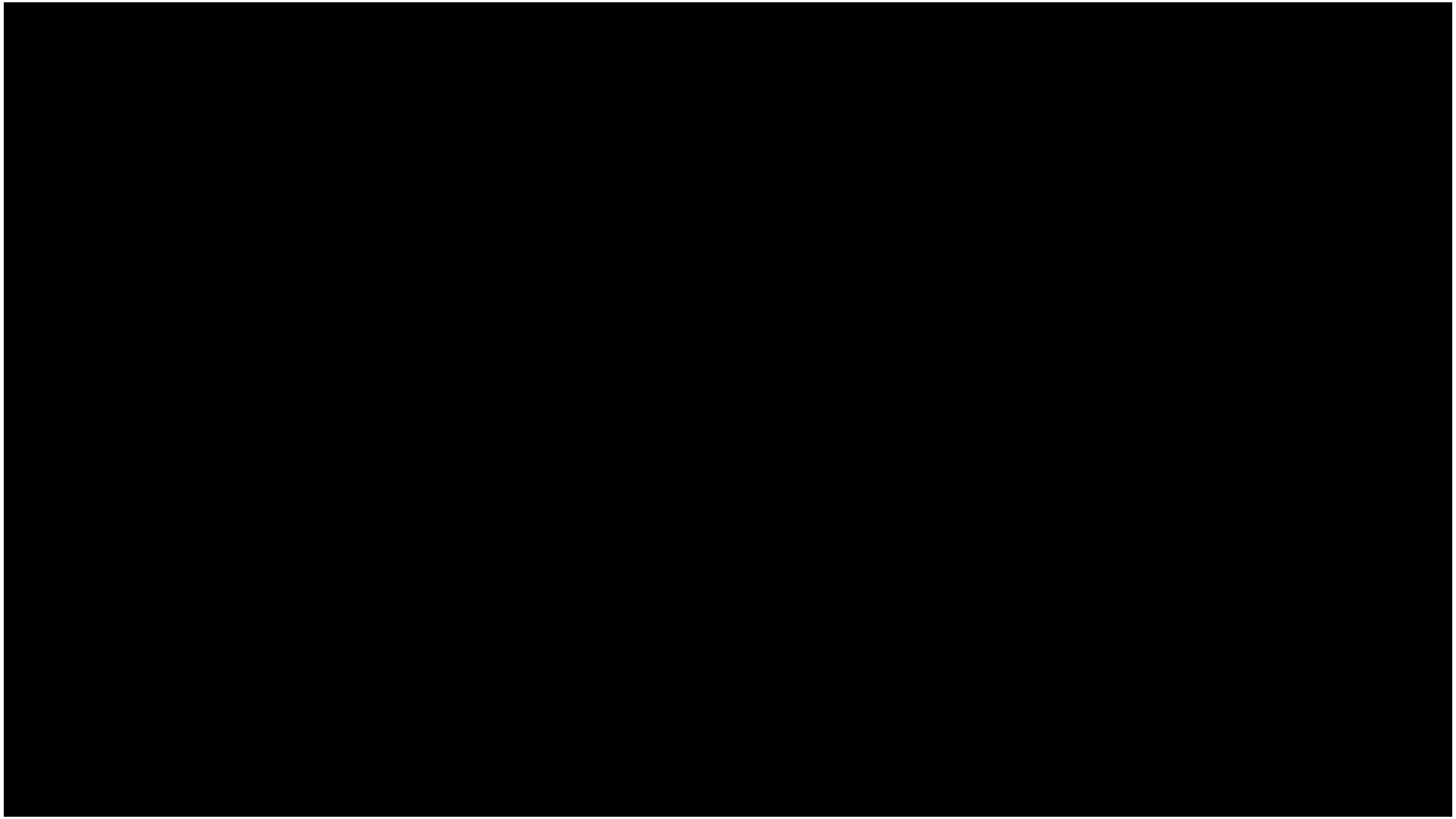
Models Agent Based Modelling:

- Ants…



Models Agent Based Modelling:

- Ants…



Models and Machine Learning:

1) Linear Model

2) Temperature Model – next temperature

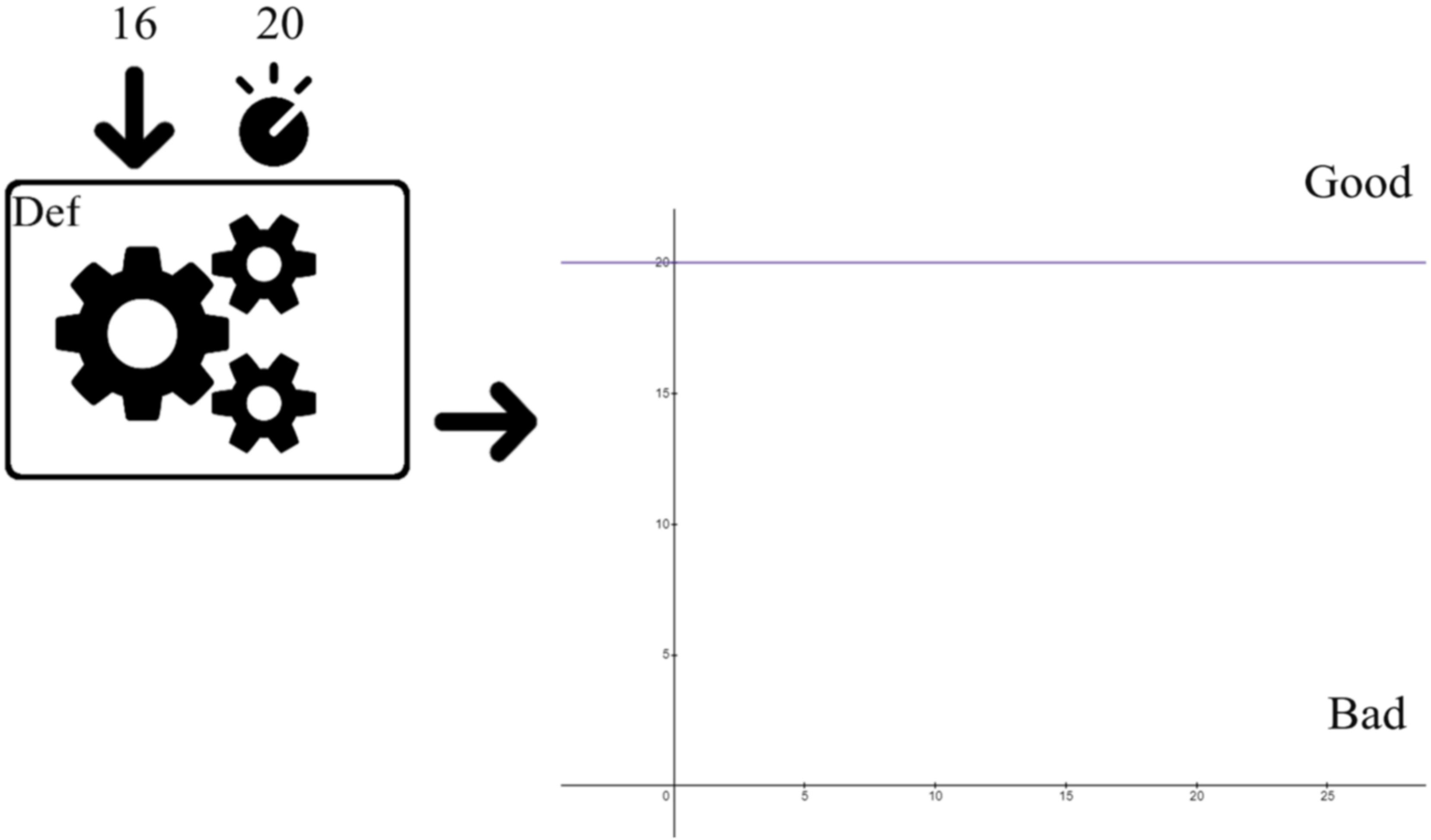
3) Compound Interest

4) Play tennis

5) Linear Regression and AI ANN

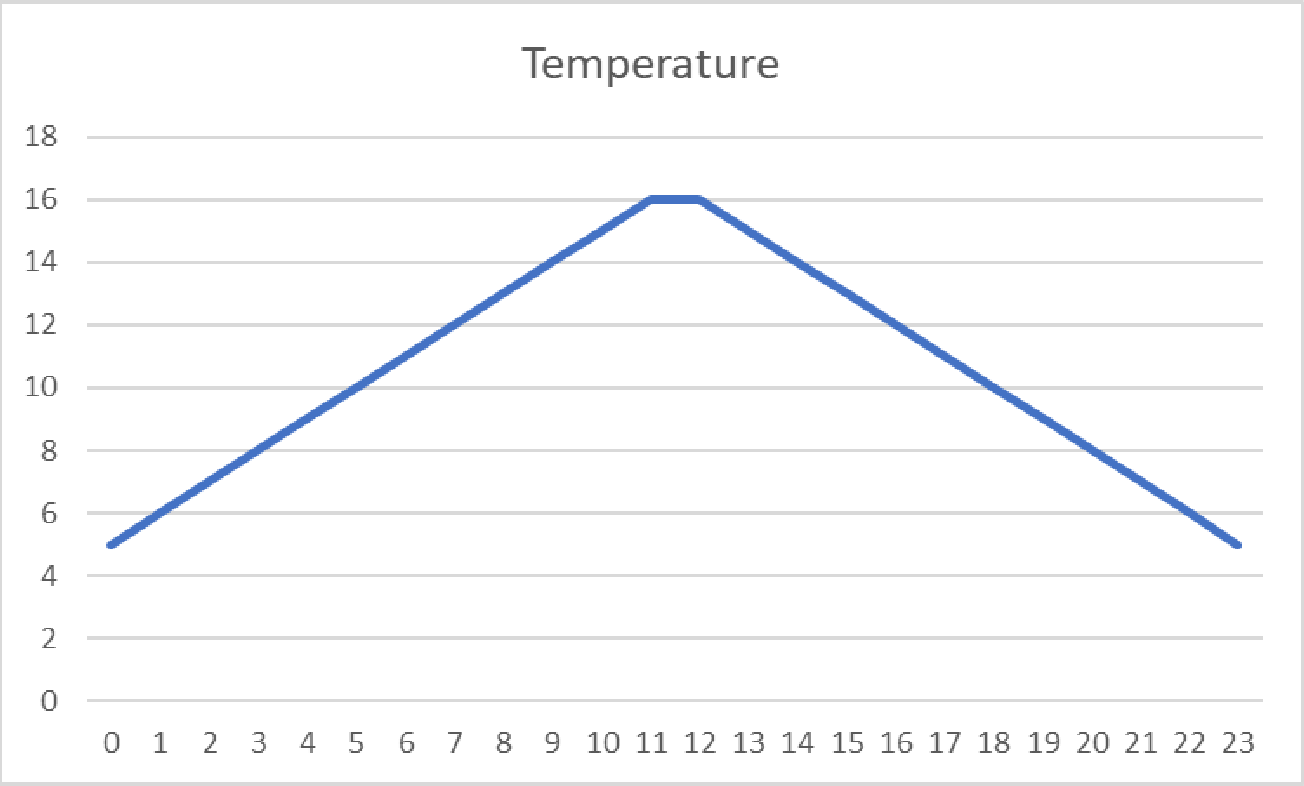
Models and Machine Learning:

1) Linear Model



Models and Machine Learning:

2) Temperature Model – next temperature



Models and Machine Learning:

3) Compound Interest

Compound Interest Formula

$M = P(1+i)^n$ where M = final amount including principal

P = principal amount

i = interest rate per year

n = number of years invested

Test Case	P	i	Years	Output
1	10000	0.032	6	167.78
2	10000	0.043	7	159.85
3	10000	0.037	4	240.92
4	10000	0.043	3	315.17
5	10000	0.044	4	247.49
6	10000	0.029	6	164.88
7	10000	0.028	7	144.44
8	10000	0.03	9	120.81

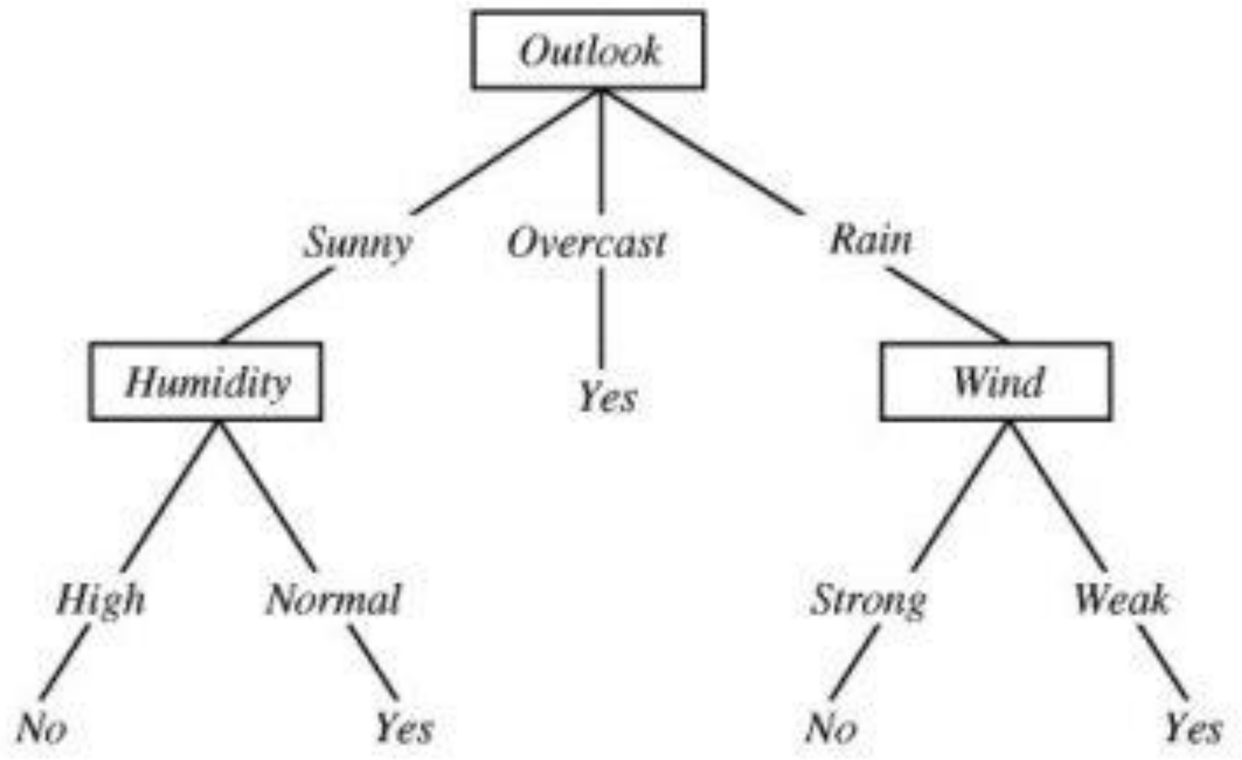
Models and Machine Learning:

4) Play tennis

Day	Outlook	Temp.	Humidity	Wind	Play?
1	Sunny	Hot	High	Weak	No
2	Sunny	Hot	High	Strong	No
3	Overcast	Hot	High	Weak	Yes
4	Rain	Mild	High	Weak	Yes
5	Rain	Cool	Normal	Weak	Yes
6	Rain	Cool	Normal	Strong	No
7	Overcast	Cool	Normal	Strong	Yes
8	Sunny	Mild	High	Weak	No
9	Sunny	Cool	Normal	Weak	Yes
10	Rain	Mild	Normal	Weak	Yes
11	Sunny	Mild	Normal	Strong	Yes
12	Overcast	Mild	High	Strong	Yes
13	Overcast	Hot	Normal	Weak	Yes
14	Rain	Mild	High	Strong	No

Models and Machine Learning:

4) Play tennis



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2	Sunny	Hot	High	Strong	No
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5	Rain	Cool	Normal	Weak	Yes
6	Rain	Cool	Normal	Strong	No
7	Overcast	Cool	Normal	Strong	Yes
8	Sunny	Mild	High	Weak	No
9	Sunny	Cool	Normal	Weak	Yes
10	Rain	Mild	Normal	Weak	Yes
11	Sunny	Mild	Normal	Strong	Yes
12	Overcast	Mild	High	Strong	Yes
13	Overcast	Hot	Normal	Weak	Yes
14	Rain	Mild	High	Strong	No

Matrices Multiplication

- Matrices are used for many complicated actions with groups of numbers.

$$[2\ x\ 2] * [2\ x\ 2] \Rightarrow [\ 2\ x\ 2]$$

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} \begin{bmatrix} w & x \\ y & z \end{bmatrix} = \begin{bmatrix} aw + by & ax + bz \\ cw + dy & cx + dz \end{bmatrix}$$

Matrices & ANN Weights….

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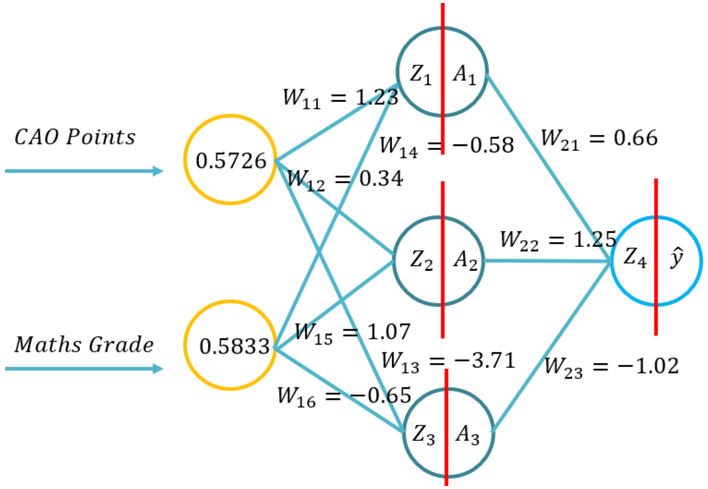


$z_1 = 0.365984$
$z_2 = -0.429447$
$z_2 = -2.503491$

$A_1 = 0.59048822$
$A_2 = 0.39425839$
$A_3 = 0.07561381$

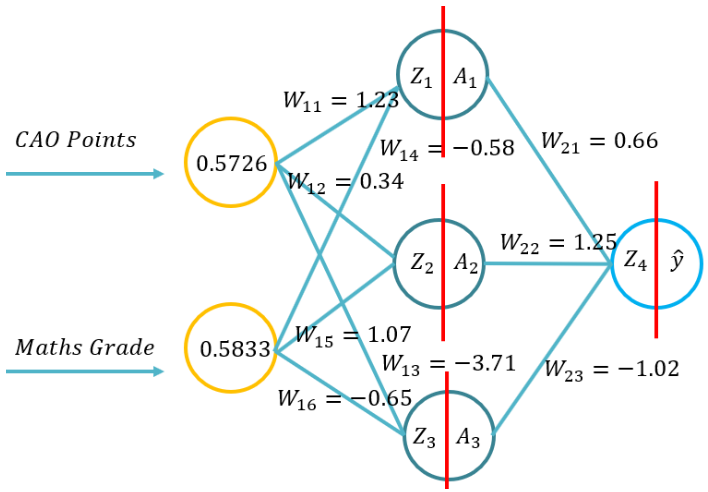
$Z_4 = 0.80541912$

$\hat{y} = 0.6911$ = 69.11%

$$[1\ x\ 2] * [2\ x\ 3] \Rightarrow [\ 1\ x\ 3]$$

$$\begin{array}{ccc} Inputs & Weights & Z_i \\ \begin{bmatrix} 0.5726 & 0.5833 \end{bmatrix} & \begin{bmatrix} 1.23 & 0.34 & -3.71 \\ -0.58 & -1.07 & -0.65 \end{bmatrix} & = \begin{bmatrix} 0.365984 & -0.429447 & -2.50.491 \end{bmatrix} \end{array}$$

Matrices & ANN Weights….



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$Z_4 = 0.80541912$

$\hat{y} = 0.6911$ = 69.11%

$$[1\ x\ 2] * [2\ x\ 3] \Rightarrow [\ 1\ x\ 3]$$

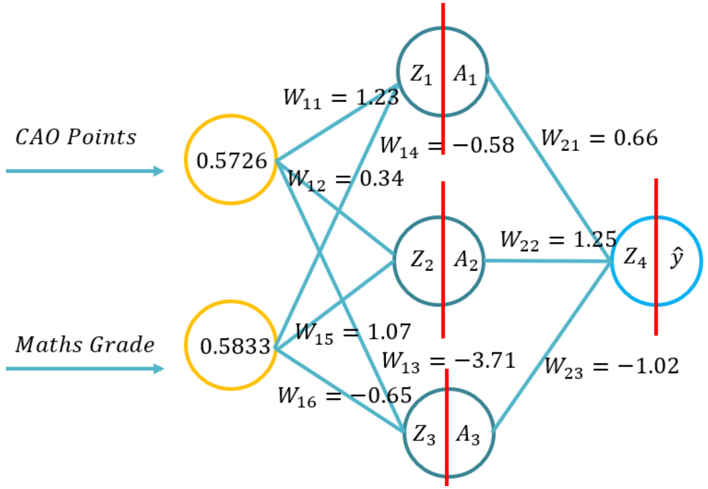
Inputs *Weights* Z_i

$$[0.5726 \quad 0.5833]\begin{bmatrix} 1.23 & 0.34 & -3.71 \\ -0.58 & -1.07 & -0.65 \end{bmatrix} = [0.365984 \quad -0.429447 \quad -2.50.491]$$

$$Z_1 = (0.5726\ x\ 1.23) + (0.5833\ \ x\ -0.58) = \ 0.704298 + (-0.34104) = 365984$$

(*note example used non rounded weights from Numpy)

Matrices & ANN Weights....



$z_1 = 0.365984$

$z_2 = -0.429447$

$z_2 = -2.503491$

$$\boxed{\begin{aligned} A_1 &= 0.59048822 \\ A_2 &= 0.39425839 \\ A_3 &= 0.07561381 \end{aligned}}$$

$Z_4 = 0.80541912$

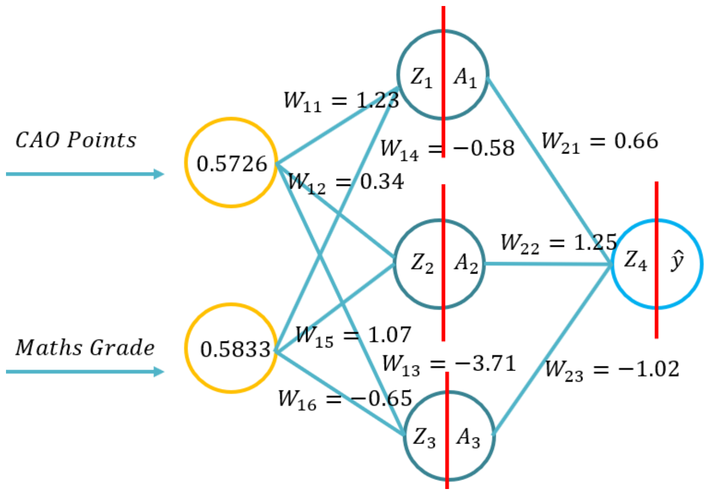
$\hat{y} = 0.6911$ = 69.11%

scaler$[1\ x\ 3] \Rightarrow [\,1\ x\ 3]$

$$\begin{array}{lcc} & Z_i & A_i \\ Activation & & \\ sigmoid & [0.365984 \quad -0.429447 \quad -2.50.491] = & [0.5904822 \quad 0.39425839 \quad 0.0756138] \end{array}$$

$Activation\ on\ each\ matrix\ element, results\ in\ the\ same\ size\ 1\ x\ 3\ matrix \Rightarrow A_i$

Matrices & ANN Weights….



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$A_2 = 0.39425839$

$A_3 = 0.07561381$

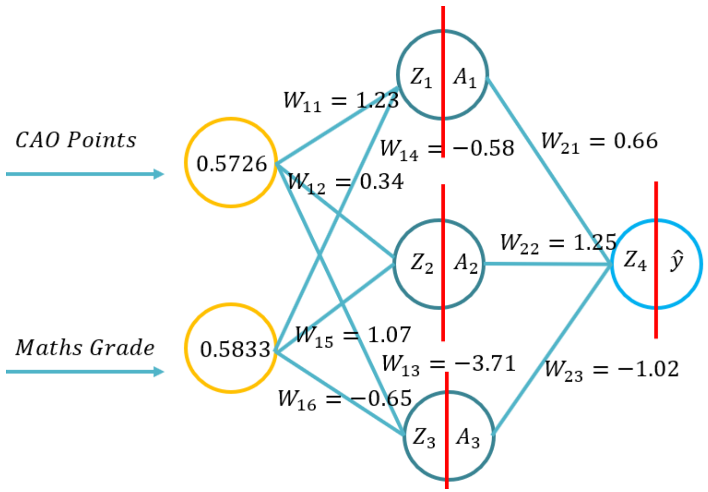
$\boxed{Z_4 = 0.80541912}$

$\hat{y} = 0.6911$ = 69.11%

$$[1\ x\ 3] * [3\ x\ 1] \Rightarrow [\ 1\ x\ 1] \Rightarrow Real\ Number$$

$$\begin{array}{ccc} A_i & Weights & Z_4 \\ [0.5904822 \quad 0.39425839 \quad 0.0756138] & \begin{bmatrix} 0.66 \\ 1.25 \\ -1.02 \end{bmatrix} & = 0.80541912 \end{array}$$

Matrices & ANN Weights….



$z_1 = 0.365984$

$z_2 = -0.429447$

$z_2 = -2.503491$

$A_1 = 0.59048822$

$A_2 = 0.39425839$

$A_3 = 0.07561381$

$Z_4 = 0.80541912$

$\boxed{\hat{y} = 0.6911 \quad = 69.11\%}$

$$[1\ x\ 3] * [3\ x\ 1] \Rightarrow [\ 1\ x\ 1] \Rightarrow Real\ Number$$

$Activation$ $\quad Z_4$ $\quad \hat{y}$

$$Sigmoid(0.80541912) \Rightarrow \frac{1}{1 + e^{(-0.80541912)}} \quad 0.6911 \Rightarrow 69.11\%$$