

Perceptron emulation with DSF

This simple perceptron decides whether an aircraft should abort takeoff or not. To do so, it takes into account the following weather conditions present on the runway, which represent a binary value:

No fog (0), with fog (1)

No rain (0), with rain (1)

No wind (0), with wind (1)

Since there are climatic factors that are more important than others, each of them is assigned a certain weight:

Fog: weight: 1

Rain: weight: 2

Wind: weight: 3

Depending on the type of combination of climatic factors, the output of the perceptron will be activated (1) or not (0). For the output to be activated, the weighted sum must be equal to or greater than 4 (bias).

Possible combinations:	Weighted sum:	Bias:	Activation:
0 0 0 > no fog, no rain, no wind	$> (0 \times 1) + (0 \times 2) + (0 \times 3) = 0 + 0 + 0 = 0$	$0 < 4$	Not activated
0 0 1 > no fog, no rain, with wind	$> (0 \times 1) + (0 \times 2) + (1 \times 3) = 0 + 0 + 3 = 3$	$3 < 4$	Not activated
0 1 0 > no fog, with rain, no wind	$> (0 \times 1) + (1 \times 2) + (0 \times 3) = 0 + 2 + 0 = 2$	$2 < 4$	Not activated
1 0 0 > with fog, no rain, no wind	$> (1 \times 1) + (0 \times 2) + (0 \times 3) = 1 + 0 + 0 = 1$	$1 < 4$	Not activated
0 1 1 > no fog, with rain, with wind	$> (0 \times 1) + (1 \times 2) + (1 \times 3) = 0 + 2 + 3 = 5$	$5 > 4$	Activated
1 0 1 > with fog, no rain, with wind	$> (1 \times 1) + (0 \times 2) + (1 \times 3) = 1 + 0 + 3 = 4$	$4 = 4$	Activated
1 1 0 > with fog, with rain, no wind	$> (1 \times 1) + (1 \times 2) + (0 \times 3) = 1 + 2 + 0 = 3$	$3 < 4$	Not activated
1 1 1 > with fog, with rain, with wind	$> (1 \times 1) + (1 \times 2) + (1 \times 3) = 1 + 2 + 3 = 6$	$6 > 4$	Activated

Possible decisions:

Output 0: Take off.

Output 1: Abort take off.

The input value 0 is represented by the element **e**. The input value 1 is represented by the element **epX₁**, **epX₂** or **epX₃**. The bias value is represented by the element **ep**.

The **epX₁** element always refers to fog (on the left in the database), the **epX₂** element always refers to rain (in the middle of the database), and the **epX₃** element always refers to wind (on the right in the database). For example, the database [**epX₁**, **e**, **epX₃**] indicates that there is fog and wind, but not rain.

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CASE 0 0 0 (no fog, no rain, no wind)

Arbitrary strength: **ep** = 3,5

step: 1

input: -

database: []

operator: **EMP**

output: -

value: 0

remain: -

step: 2 > Preload data (bias)

input: **ep**

database: [**ep**]

operator: **ONL**

output: **ep**

value: 0

remain: -

step: 3 > Weather data (fog, rain, wind)

input: **e, e, e**

database: [**ep** | **e, e, e**]

operator: **ONL**

output: **ep** > Not activated (TAKE OFF)

value: 0

remain: **e, e, e**

CASE 0 0 1 (no fog, no rain, with wind)

Arbitrary strength: **ep** = 3,5 **epX₃** = 3

step: 1

input: -

database: []

operator: **EMP**

output: -

value: 0

remain: -

step: 2 > Preload data (bias)

input: **ep**

database: [ep]

operator: **ONL**

output: **ep**

value: 0

remain: -

step: 3 > Weather data (fog, rain, wind)

input: **e, e, epX₃**

database: [ep | **e, e, epX₃**]

operator: **STR**

output: **ep** > Not activated (TAKE OFF)

value: 0

remain: **e, e, epX₃**

CASE 0 1 0 (no fog, with rain, no wind)

Arbitrary strength: **ep** = 3,5 **epX₂** = 2

step: 1

input: -

database: []

operator: **EMP**

output: -

value: 0

remain: -

step: 2 > Preload data (bias)

input: **ep**

database: [**ep**]

operator: **ONL**

output: **ep**

value: 0

remain: -

step: 3 > Weather data (fog, rain, wind)

input: **e**, **epX₂**, **e**

database: [**ep** | **e**, **epX₂**, **e**]

operator: **STR**

output: **ep** > Not activated (TAKE OFF)

value: 0

remain: **e**, **epX₂**, **e**

CASE 1 0 0 (with fog, no rain, no wind)

Arbitrary strength: **ep** = 3,5 **epX₁** = 1

step: 1

input: -

database: []

operator: **EMP**

output: -

value: 0

remain: -

step: 2 > Preload data (bias)

input: **ep**

database: [**ep**]

operator: **ONL**

output: **ep**

value: 0

remain: -

step: 3 > Weather data (fog, rain, wind)

input: **epX₁**, **e**, **e**

database: [**ep** | **epX₁**, **e**, **e**]

operator: **STR**

output: **ep** > Not activated (TAKE OFF)

value: 0

remain: **epX₁**, **e**, **e**

CASE 0 1 1 (no fog, with rain, with wind)

Arbitrary strength: **ep** = 3,5 **epX₂** = 2 **epX₃** = 3

step: 1

input: -

database: []

operator: **EMP**

output: -

value: 0

remain: -

step: 2 > Preload data (bias)

input: **ep**

database: [**ep**]

operator: **ONL**

output: **ep**

value: 0

remain: -

step: 3 > Weather data (fog, rain, wind)

input: **e**, **epX₂**, **epX₃**

database: [**ep** | **e**, **epX₂**, **epX₃**]

operator: (**MAJ**)**STR**

output: **epX₃** > **Activated (ABORT TAKE OFF)**

value: 1

remain: **ep**, **e**, **epX₂** <---- (alternative remain)

CASE 1 0 1 (**with fog**, **no rain**, **with wind**)

Arbitrary strength: **ep** = 3,5 **epX₁** = 1 **epX₃** = 3

step: 1

input: -

database: []

operator: **EMP**

output: -

value: 0

remain: -

step: 2 > Preload data (bias)

input: **ep**

database: [**ep**]

operator: **ONL**

output: **ep**

value: 0

remain: -

step: 3 > Weather data (fog, rain, wind)

input: **epX₁**, **e**, **epX₃**

database: [**ep** | **epX₁**, **e**, **epX₃**]

operator: (**MAJ**)**STR**

output: **epX₃** > **Activated (ABORT TAKE OFF)**

value: 1

remain: **ep**, **epX₁**, **e** <---- (alternative remain)

CASE 1 1 0 (**with fog**, **with rain**, **no wind**)

Arbitrary strength: **ep** = 3,5 **epX₁** = 1 **epX₂** = 2

step: 1

input: -

database: []

operator: **EMP**

output: -

value: 0

remain: -

step: 2 > Preload data (bias)

input: **ep**

database: [**ep**]

operator: **ONL**

output: **ep**

value: 0

remain: -

step: 3 > Weather data (fog, rain, wind)

input: **epX₁**, **epX₂**, **e**

database: [**ep** | **epX₁**, **epX₂**, **e**]

operator: **STR**

output: **ep** > No activated (TAKE OFF)

value: 0

remain: **epX₁**, **epX₂**, **e**

CASE 1 1 1 (**with fog**, **with rain**, **with wind**)

Arbitrary strength: **ep** = 3,5 **epX₁** = 1 **epX₂** = 2 **epX₃** = 3

step: 1

input: -

database: []

operator: **EMP**

output: -

value: 0

remain: -

step: 2 > Preload data (bias)

input: **ep**

database: [**ep**]

operator: **ONL**

output: **ep**

value: 0

remain: -

step: 3 > Weather data (fog, rain, wind)

input: **epX₁**, **epX₂**, **epX₃**

database: [**ep** | **epX₁**, **epX₂**, **epX₃**]

operator: (**MAJ**)**STR**

output: **epX₃** > **Activated (ABORT TAKE OFF)**

value: 1

remain: **ep**, **epX₁**, **epX₂** <---- (alternative remain)

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