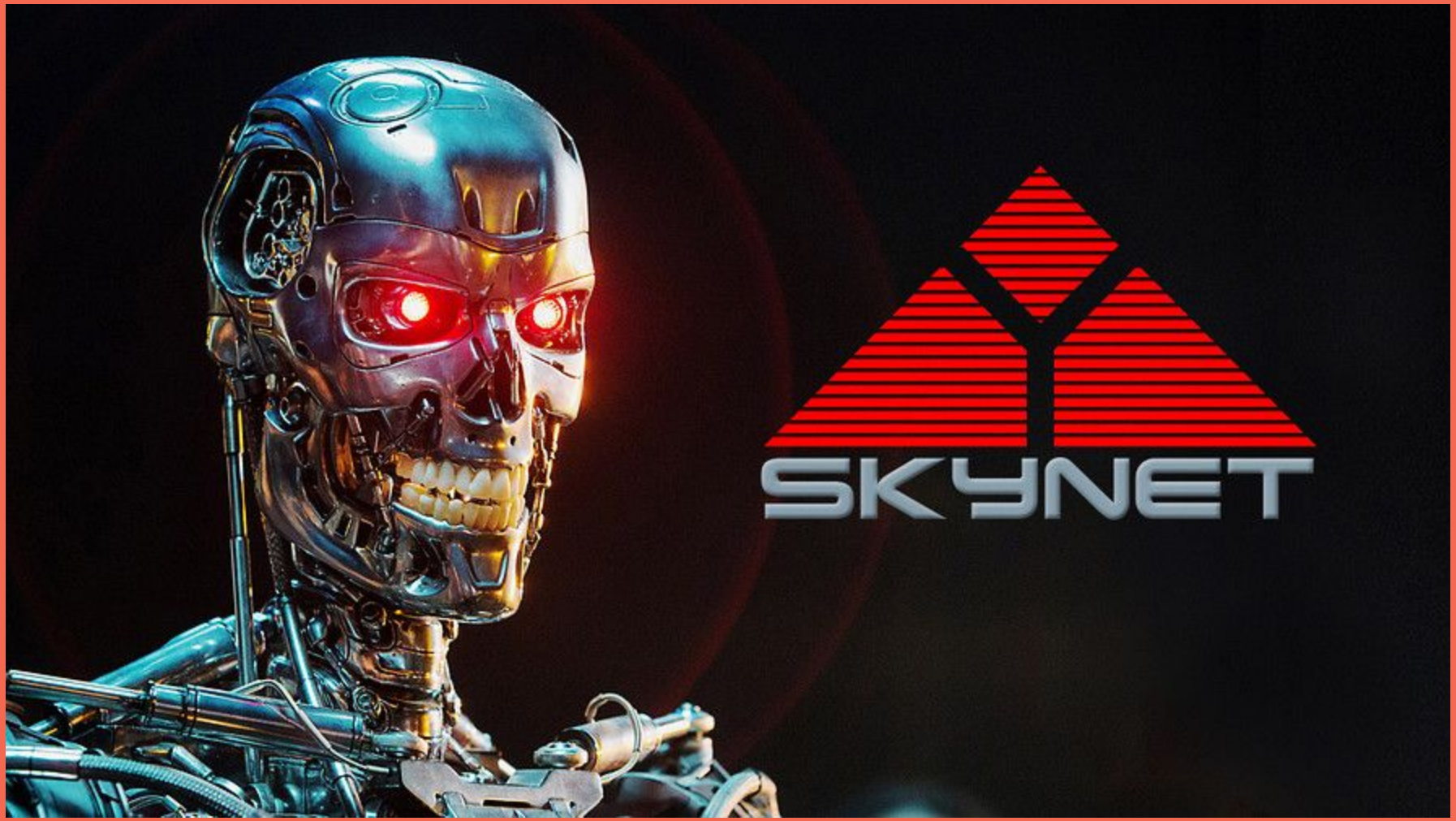
ideato

MACHINE LEARNING

Che roba è? Come funziona? E’ davvero magia?

“The business plans of the next 10,000 startups are easy to forecast: Take X and add AI.”

Kevin Kelly - Fondatore di Wired

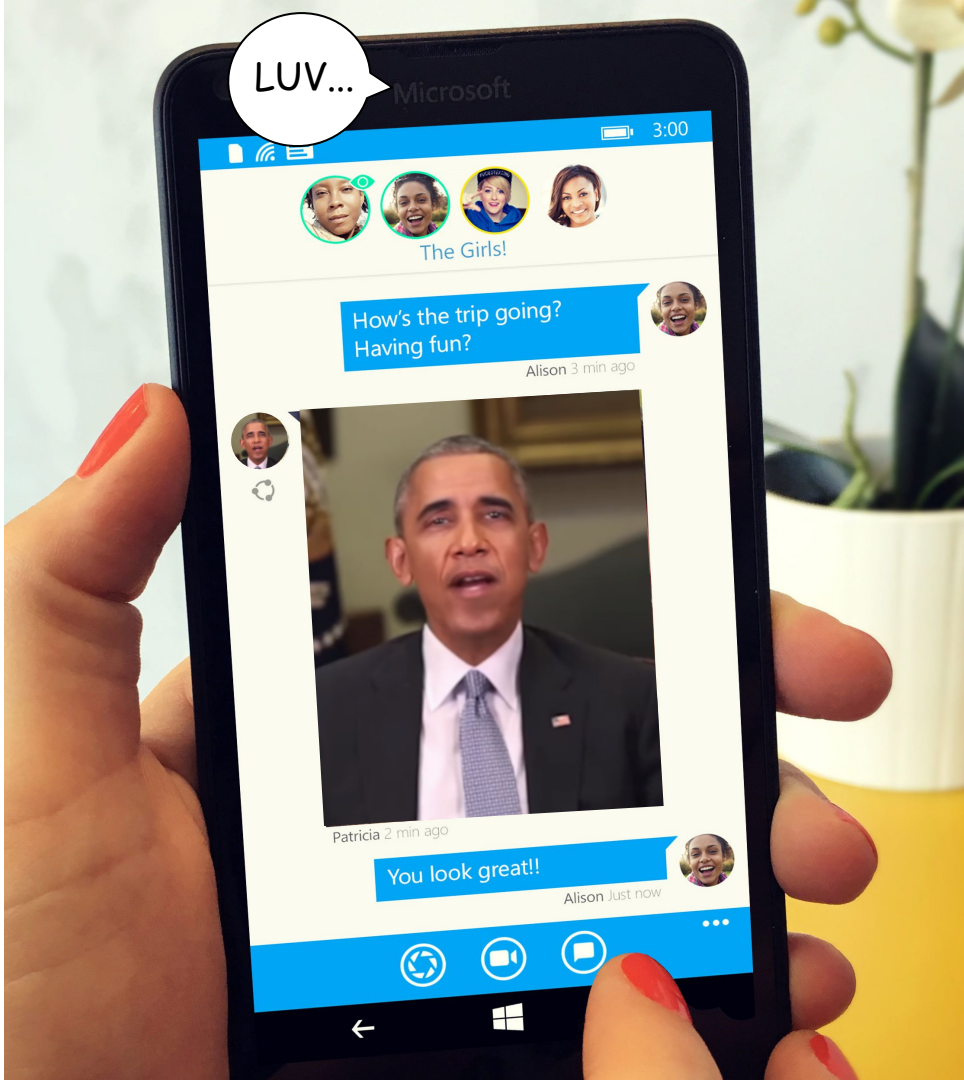

SKYNET

App rivoluzionaria

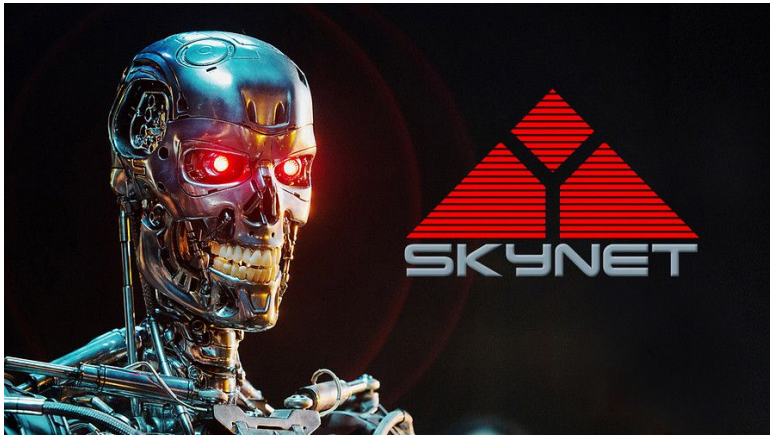
Video messaggi da un personaggio famoso.

Labiale importantissimo

Mio cugginо dice che lui lo sa fare...



Facciamo chiarezza: intelligenza artificiale



Facciamo chiarezza: intelligenza artificiale

Non c’è una definizione ufficiale

Design di sistemi che dimostrano la capacità di **raggiungere un obiettivo specifico** anche in domini complessi

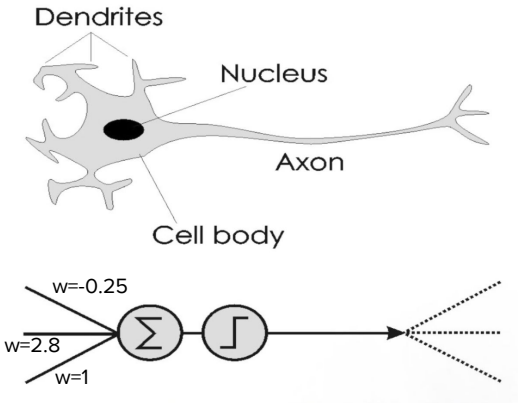
Un **sistema esperto** basato su regole prefissate (IF-THEN) o su alberi risulta “intelligente”

Facciamo chiarezza: machine learning

Facciamo chiarezza: machine learning

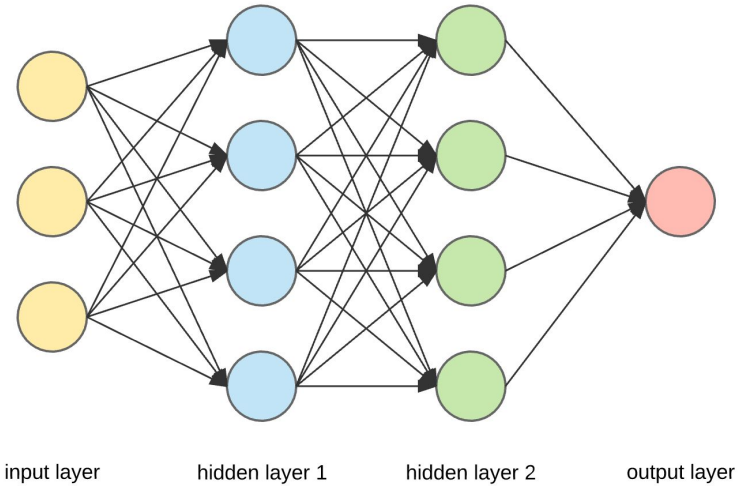
Disciplina che mira a costruire **comportamenti intelligenti** senza che questi siano esplicitamente programmati per seguire regole prestabilite, ma mediante **apprendimento**

Facciamo chiarezza: neural networks



Reti neurali
(nate nel 1943)

Facciamo chiarezza: deep learning



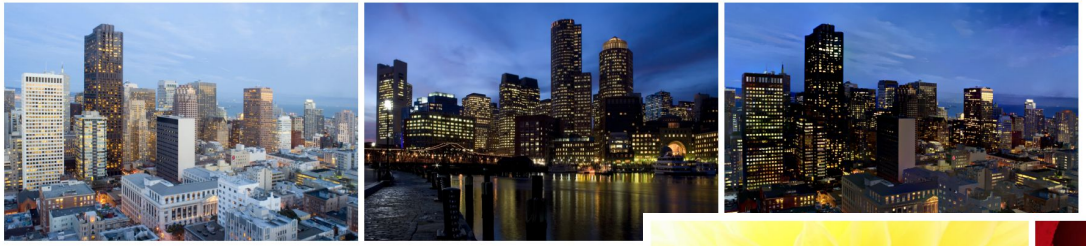
Reti “profonde”
(concetto del 1986, realizzato nel 2000)

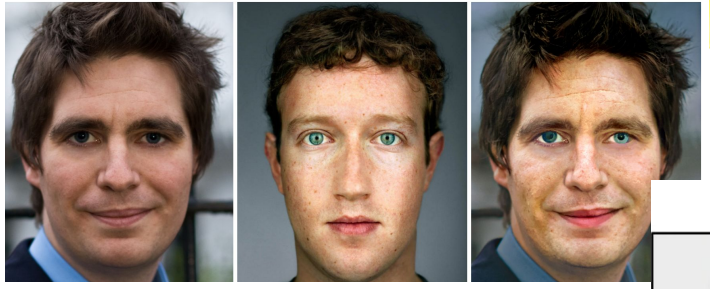
Facciamo chiarezza: deep learning

Tecnica di machine learning che si fonda sulle **Deep Neural Network**: reti neurali con più di due hidden layer

machine learning: cosa ci si può fare?

Trasferimento di stile



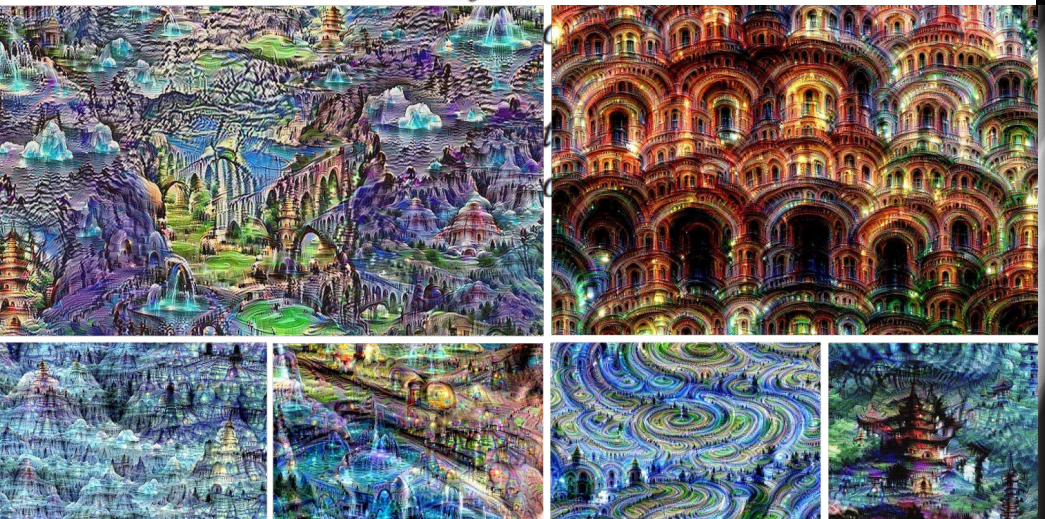


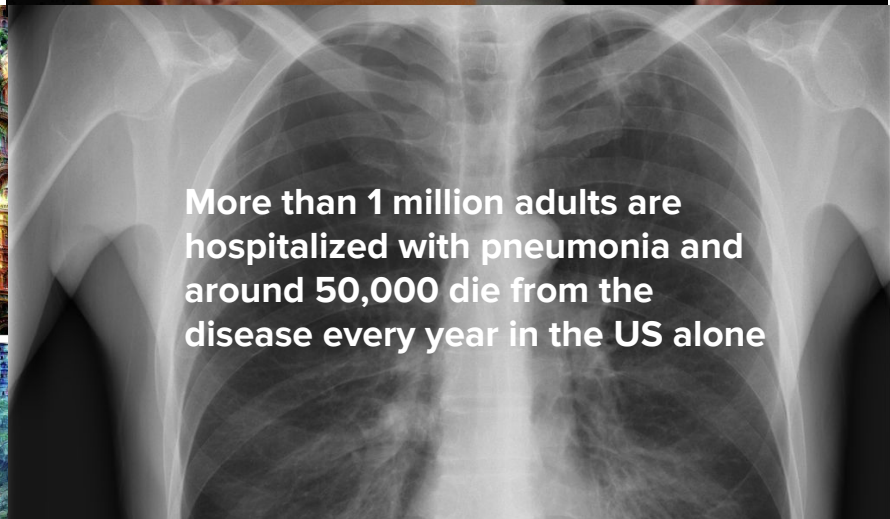
Sequenze di note

Ambienti complessi

Creatività (?)

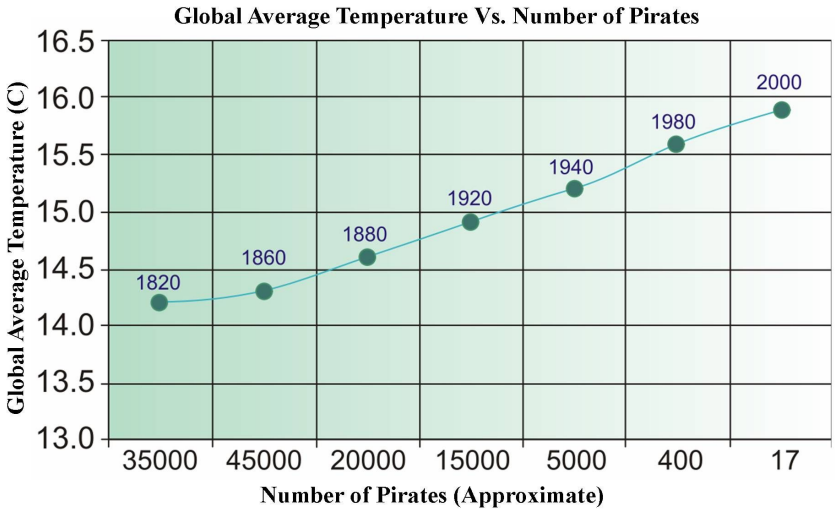
Human: *what is the purpose of life ?*
Machine: *to serve the greater good .*
Human: *what is the purpose of living ?*
Machine: *to live forever .*
Human: *what is the purpose of existence ?*
Machine: *to find out what happens when we get to the planet earth .*
Human: *where are you now ?*
Machine: *i 'm in the middle of nowhere .*
Human: *what is the purpose of dying ?*
Machine: *to have a life .*



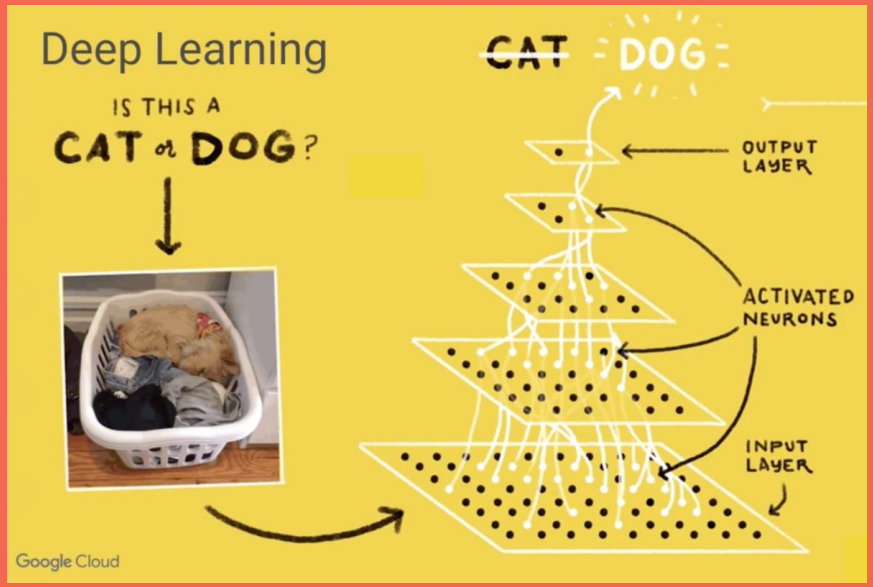


come è possibile?

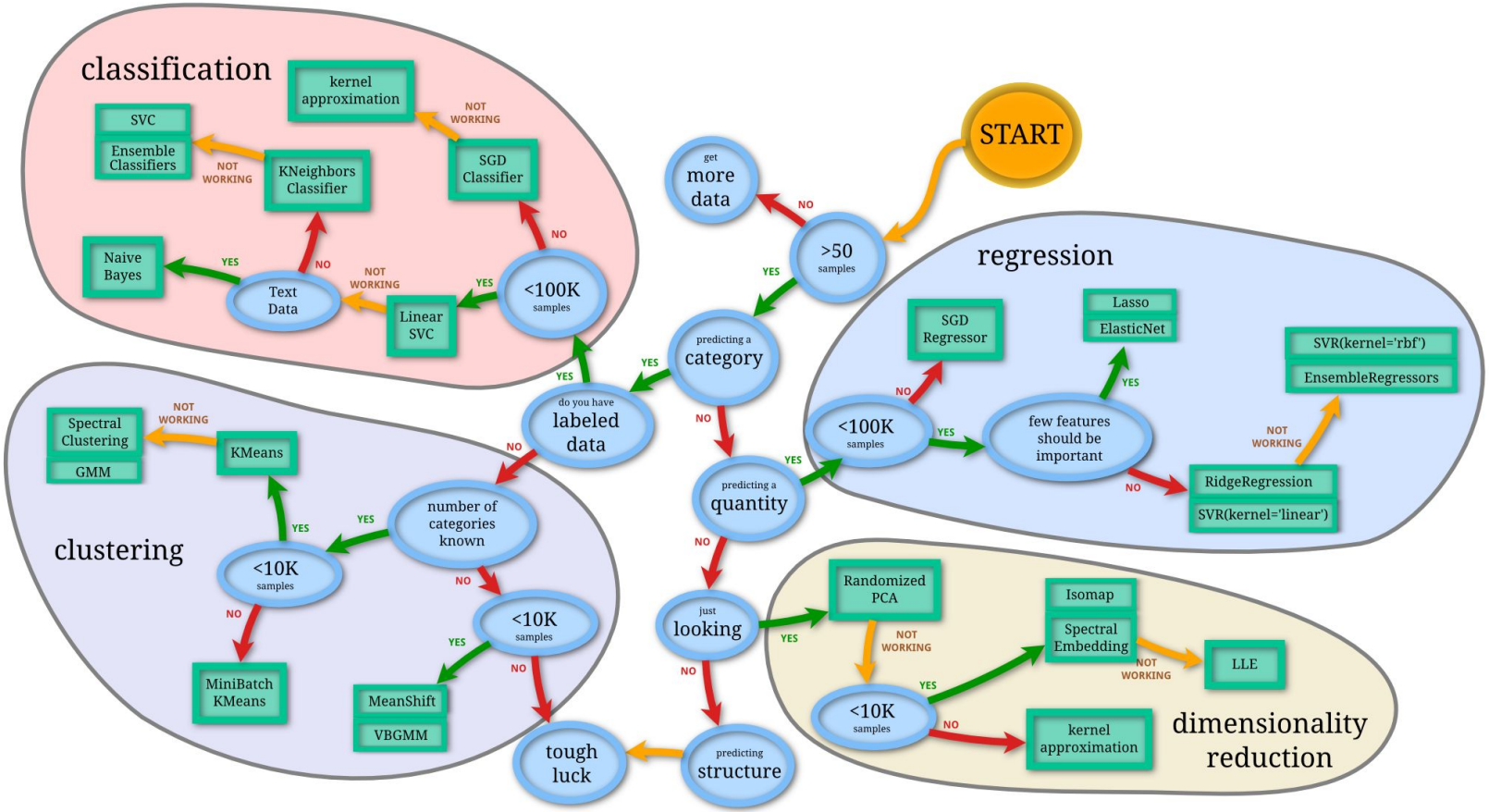
Algoritmi statistici



Reti neurali



Algoritmi statistici



A mostly complete chart of

Neural Networks

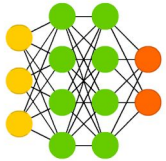
- Backfed Input Cell
- Input Cell
- Noisy Input Cell
- Hidden Cell
- Probablistic Hidden Cell
- Spiking Hidden Cell
- Output Cell
- Match Input Output Cell
- Recurrent Cell
- Memory Cell
- Different Memory Cell
- Kernel
- Convolution or Pool

Perceptron (P)

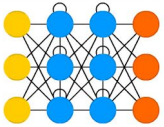
Feed Forward (FF)

Radial Basis Network (RBF)

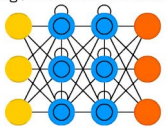
Deep Feed Forward (DFF)



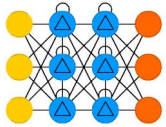
Recurrent Neural Network (RNN)



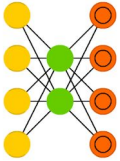
Long / Short Term Memory (LSTM)



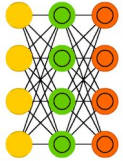
Gated Recurrent Unit (GRU)



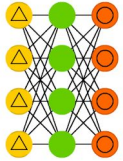
Auto Encoder (AE)



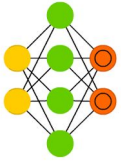
Variational AE (VAE)



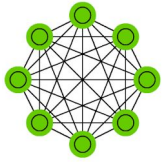
Denoising AE (DAE)



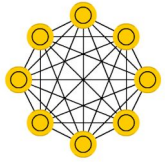
Sparse AE (SAE)



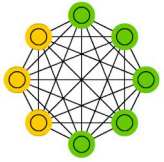
Markov Chain (MC)



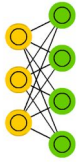
Hopfield Network (HN)



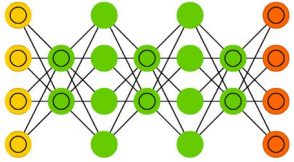
Boltzmann Machine (BM)



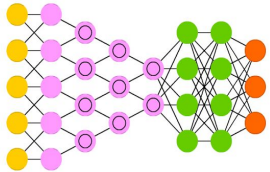
Restricted BM (RBM)



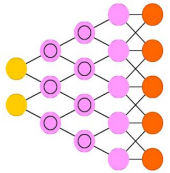
Deep Belief Network (DBN)



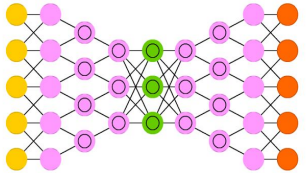
Deep Convolutional Network (DCN)



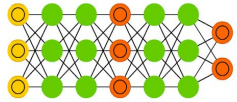
Deconvolutional Network (DN)



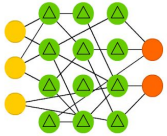
Deep Convolutional Inverse Graphics Network (DCIGN)



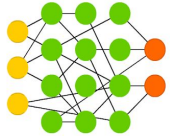
Generative Adversarial Network (GAN)



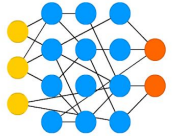
Liquid State Machine (LSM)



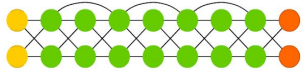
Extreme Learning Machine (ELM)



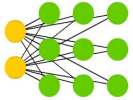
Echo State Network (ESN)



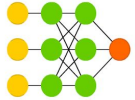
Deep Residual Network (DRN)



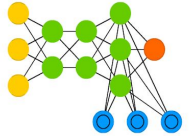
Kohonen Network (KN)



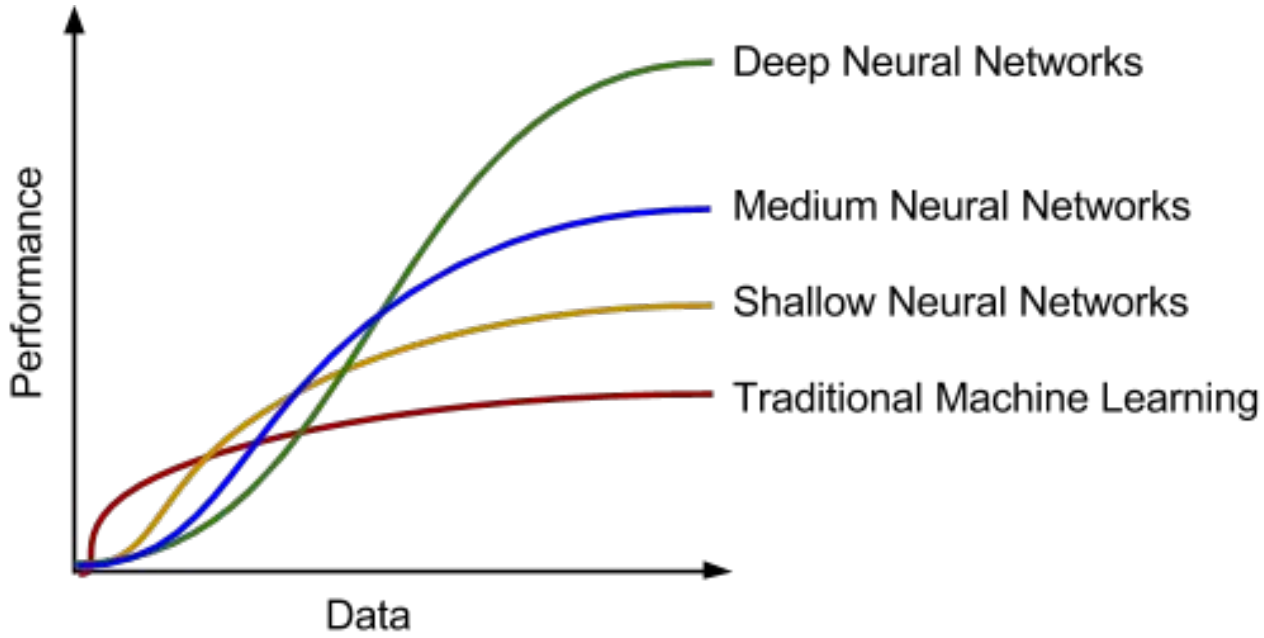
Support Vector Machine (SVM)



Neural Turing Machine (NTM)



Che differenza c'è?



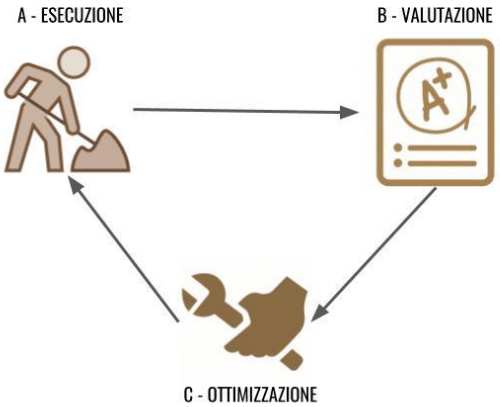
*

ok

ma come funzionano?

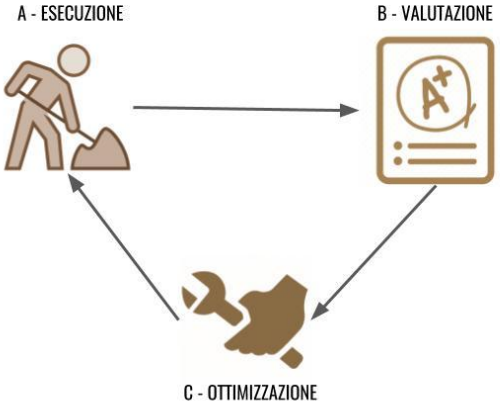
Tecniche di Apprendimento

Supervisionato



Tecniche di Apprendimento

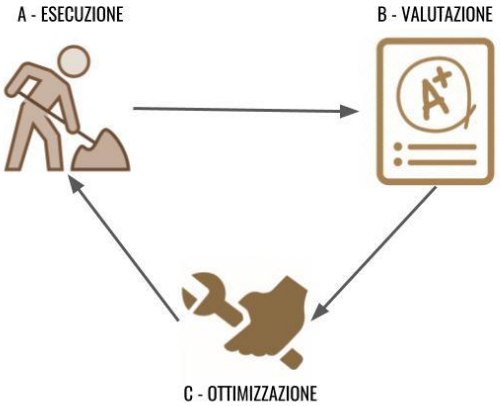
Supervisionato



Non supervisionato

Tecniche di Apprendimento

Supervisionato

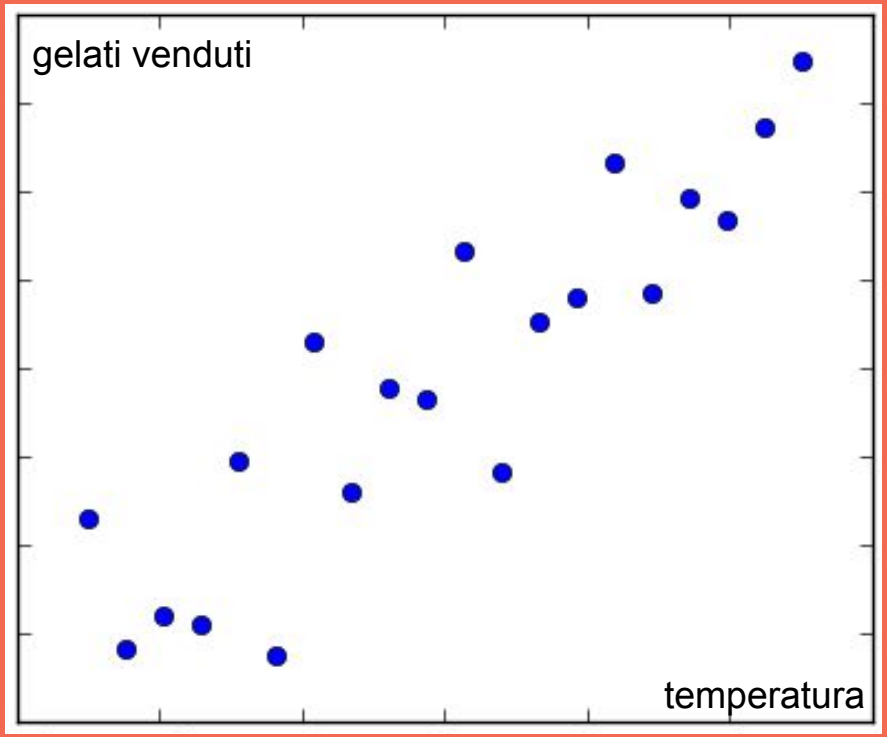


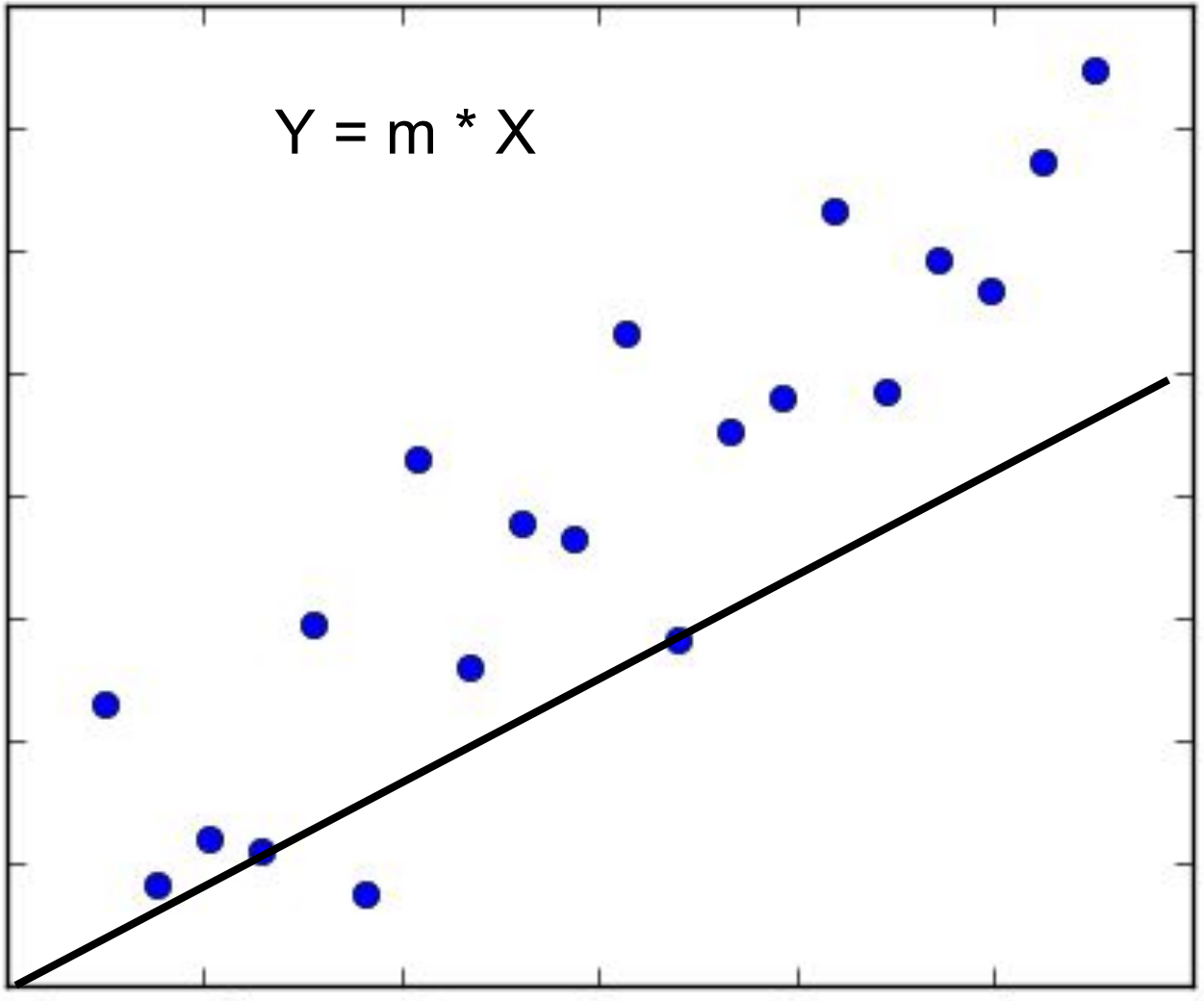
Non supervisionato

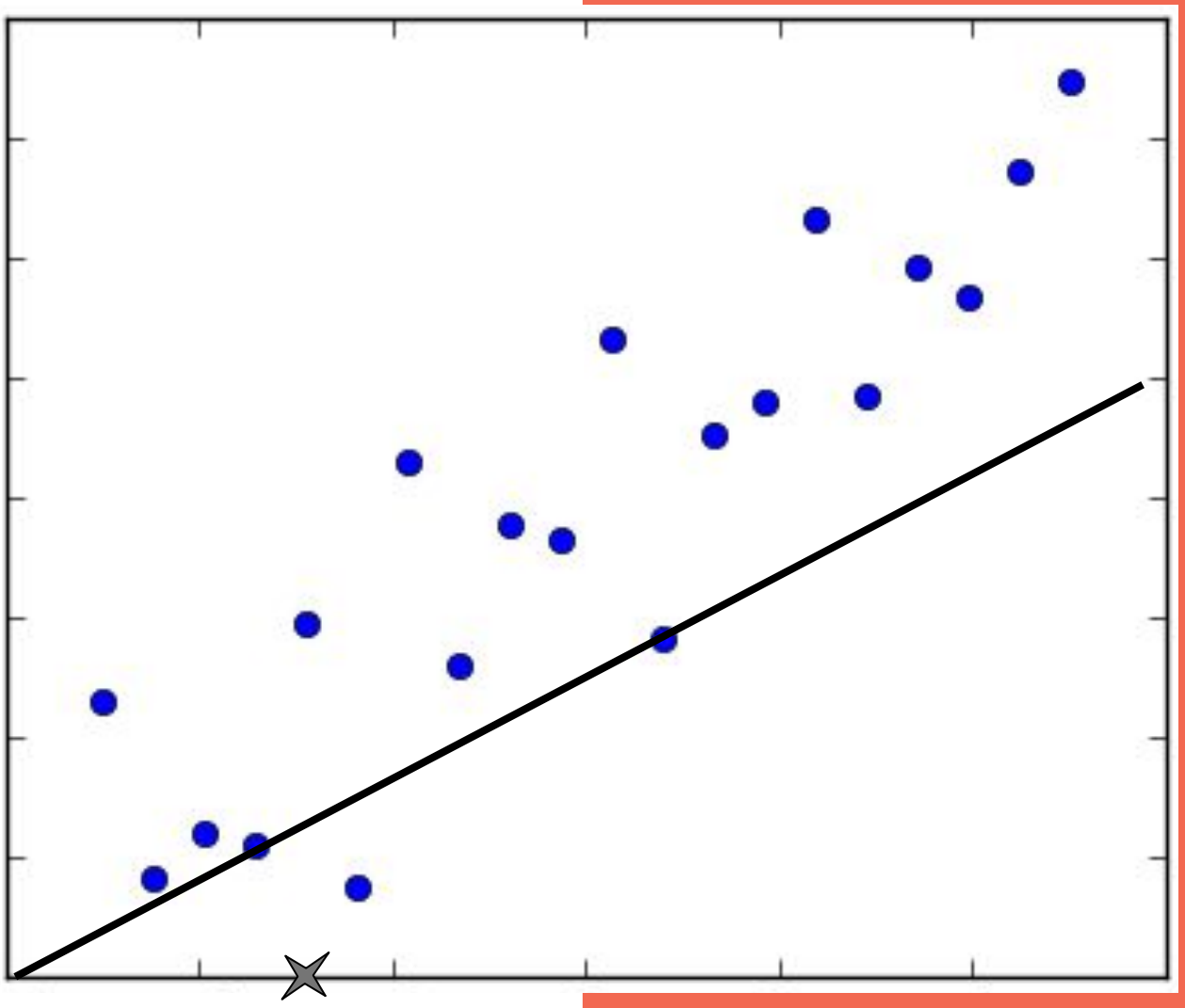
Per rinforzo

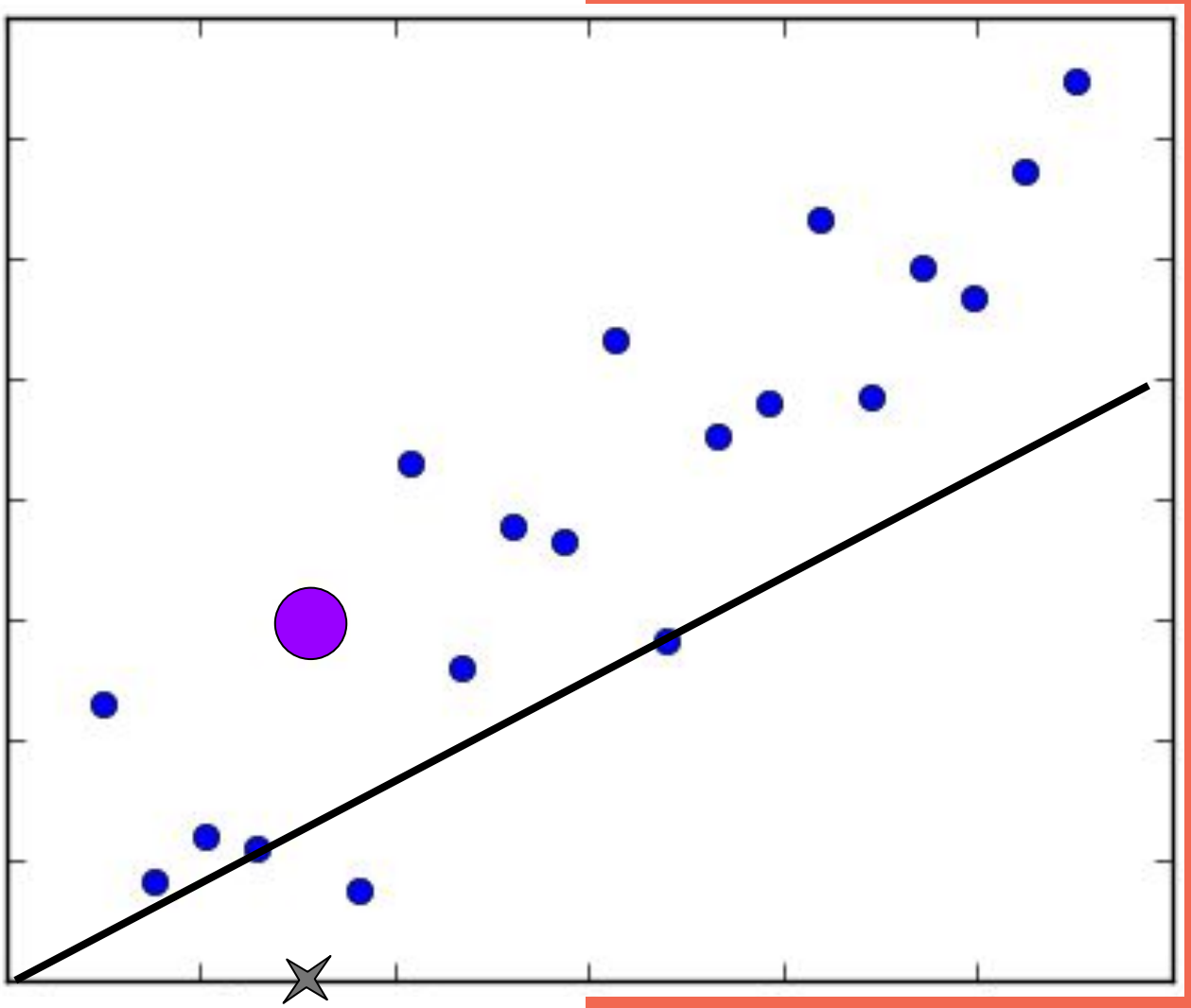
Apprendimento

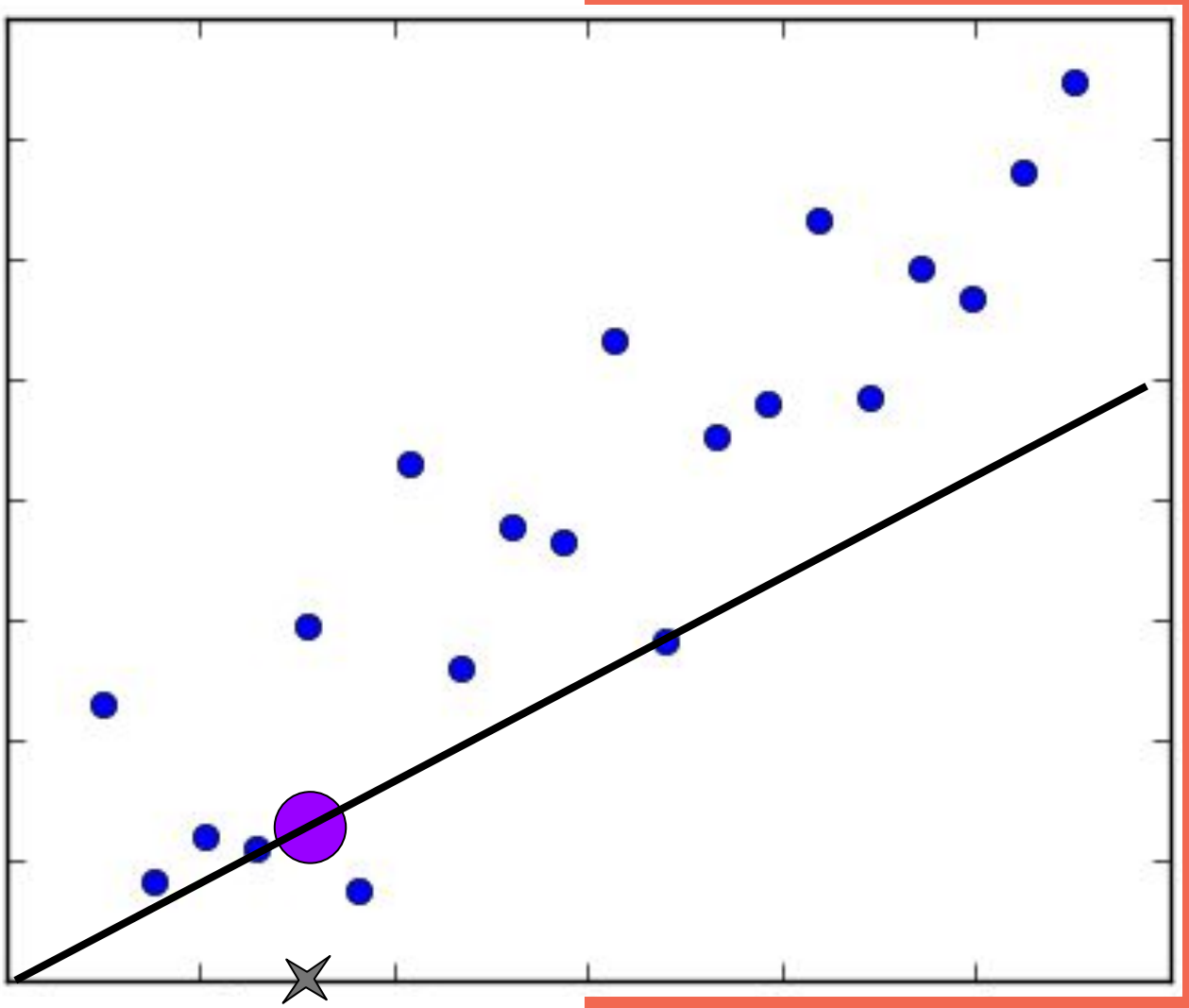
Addestramento di un’equazione che approssimi in maniera ottimale i dati

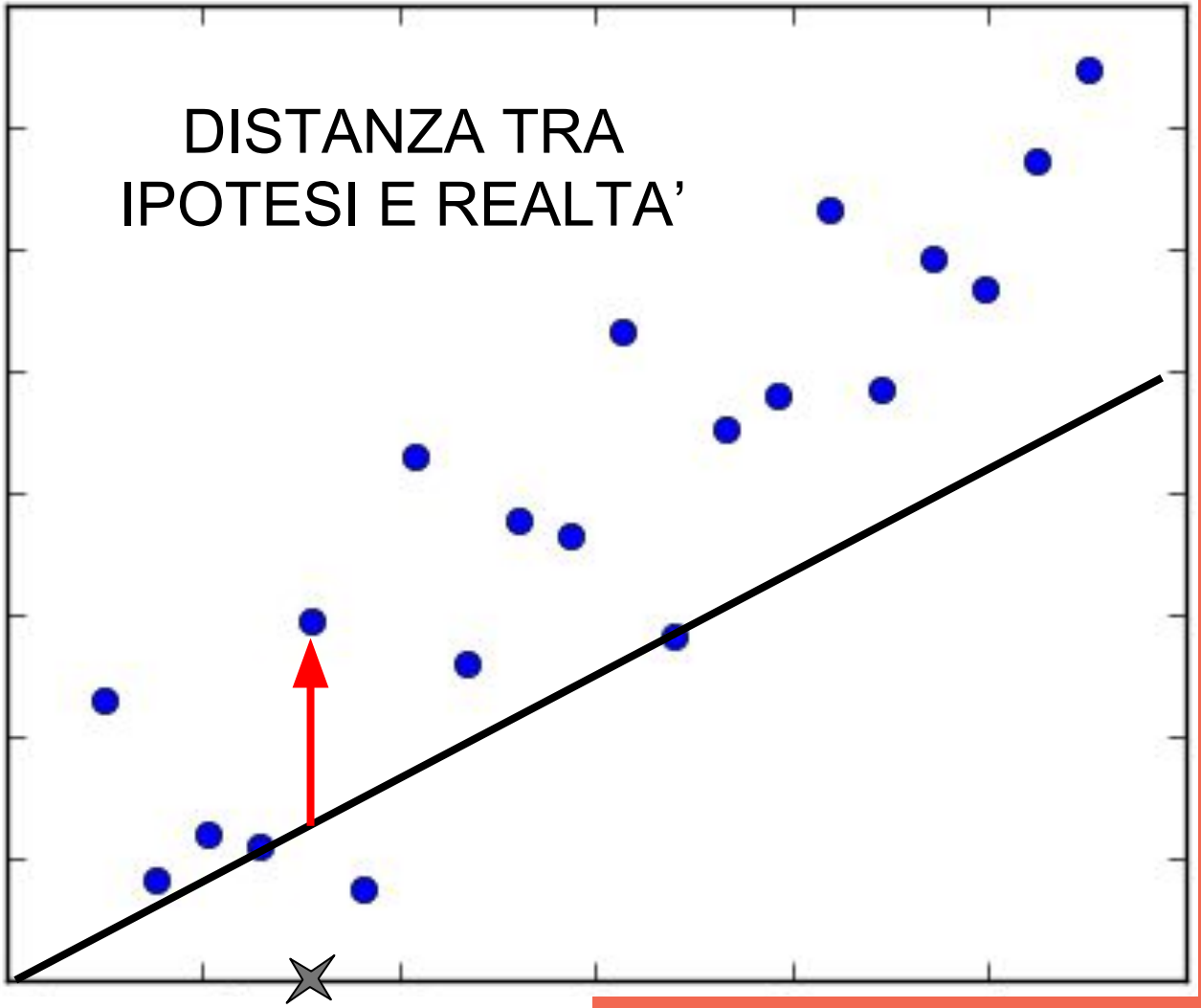


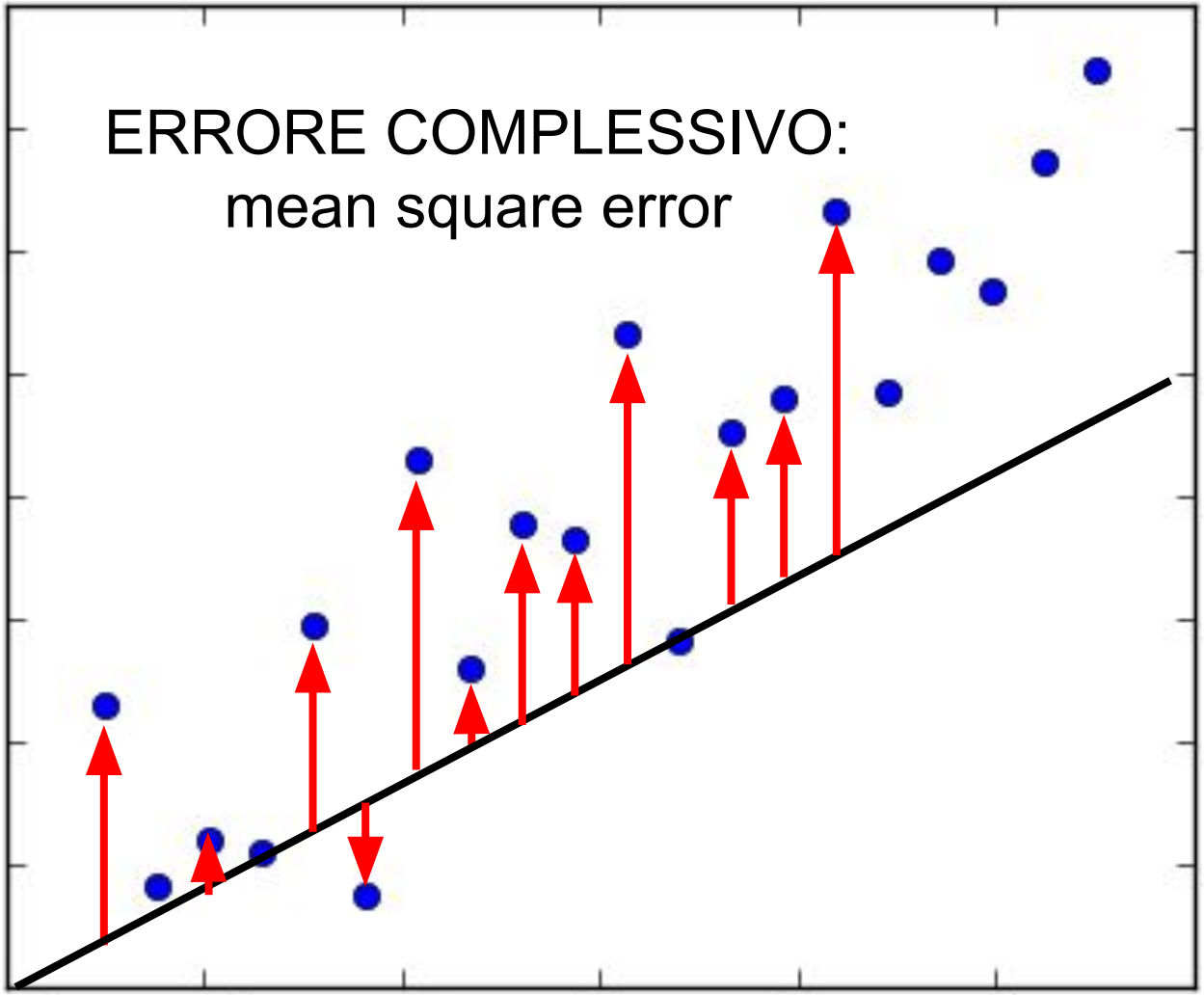

Y = m * X

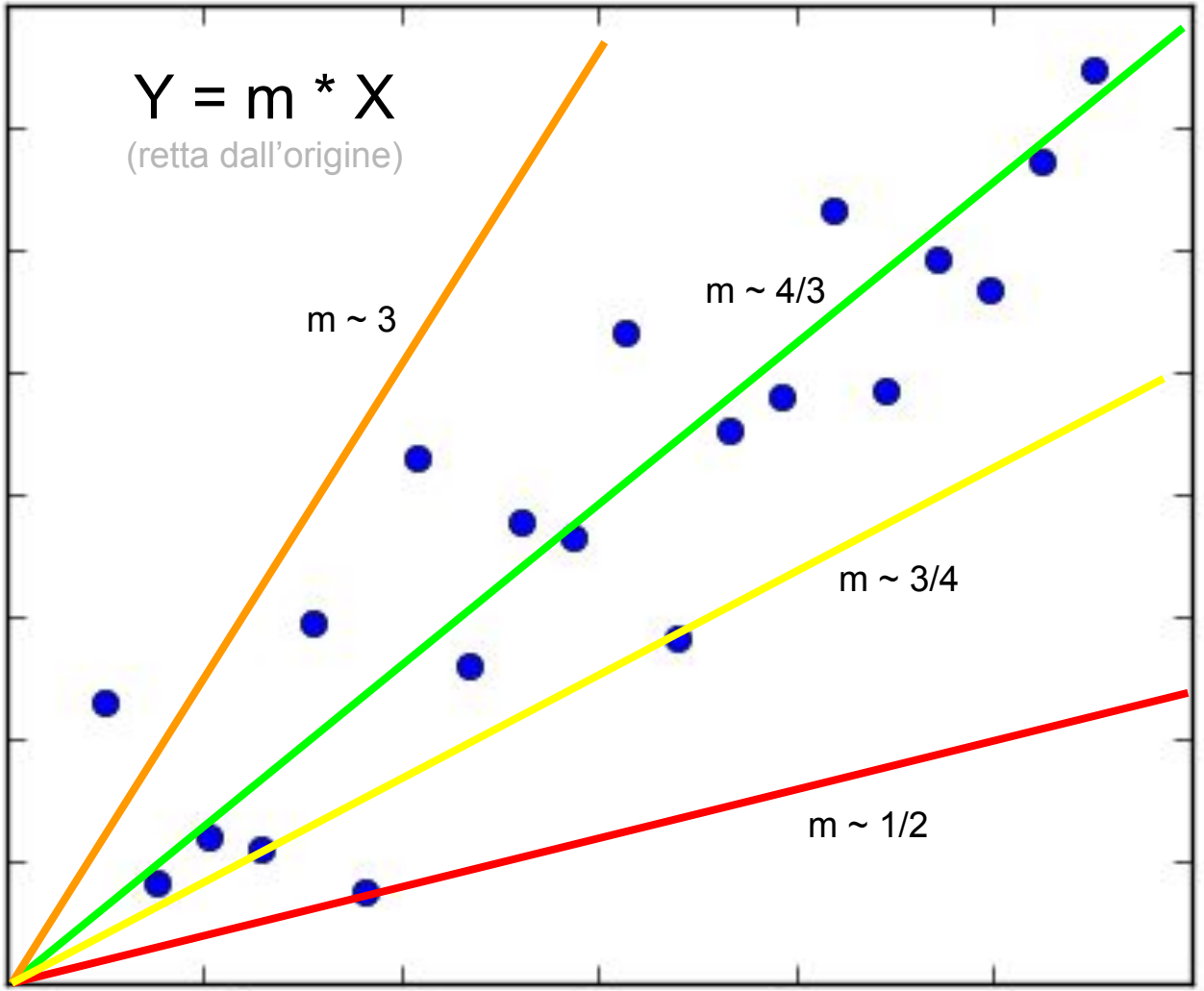


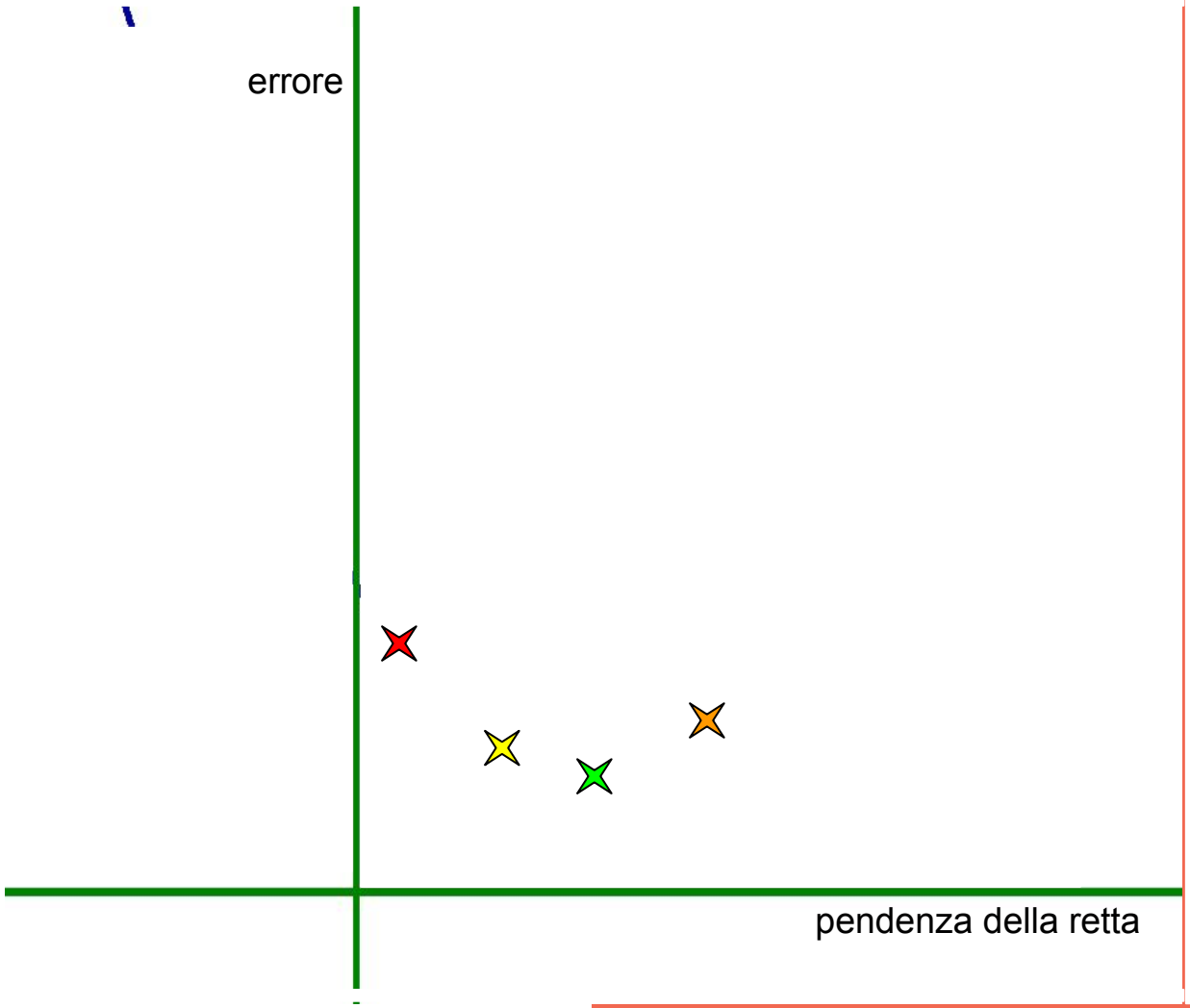


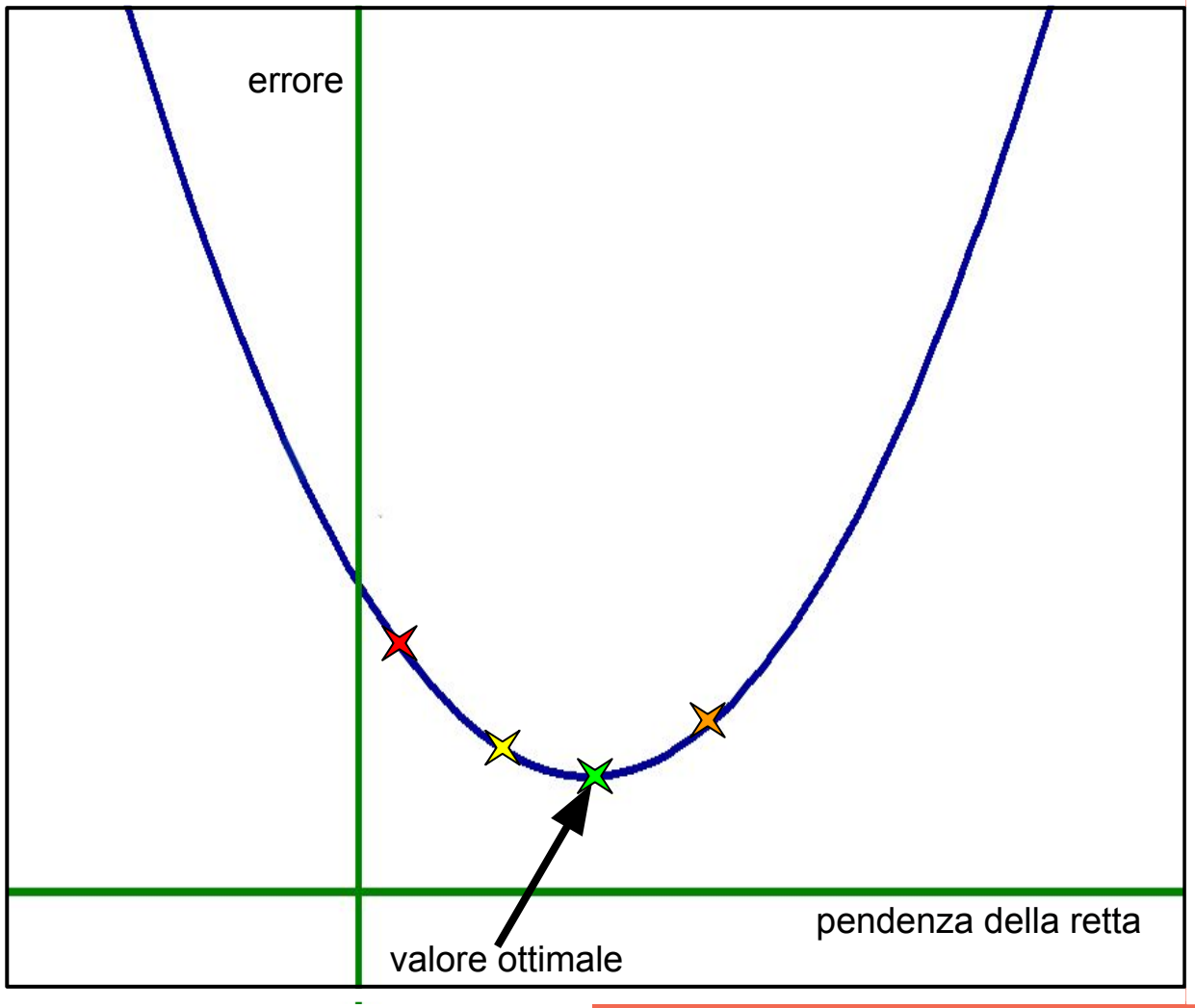


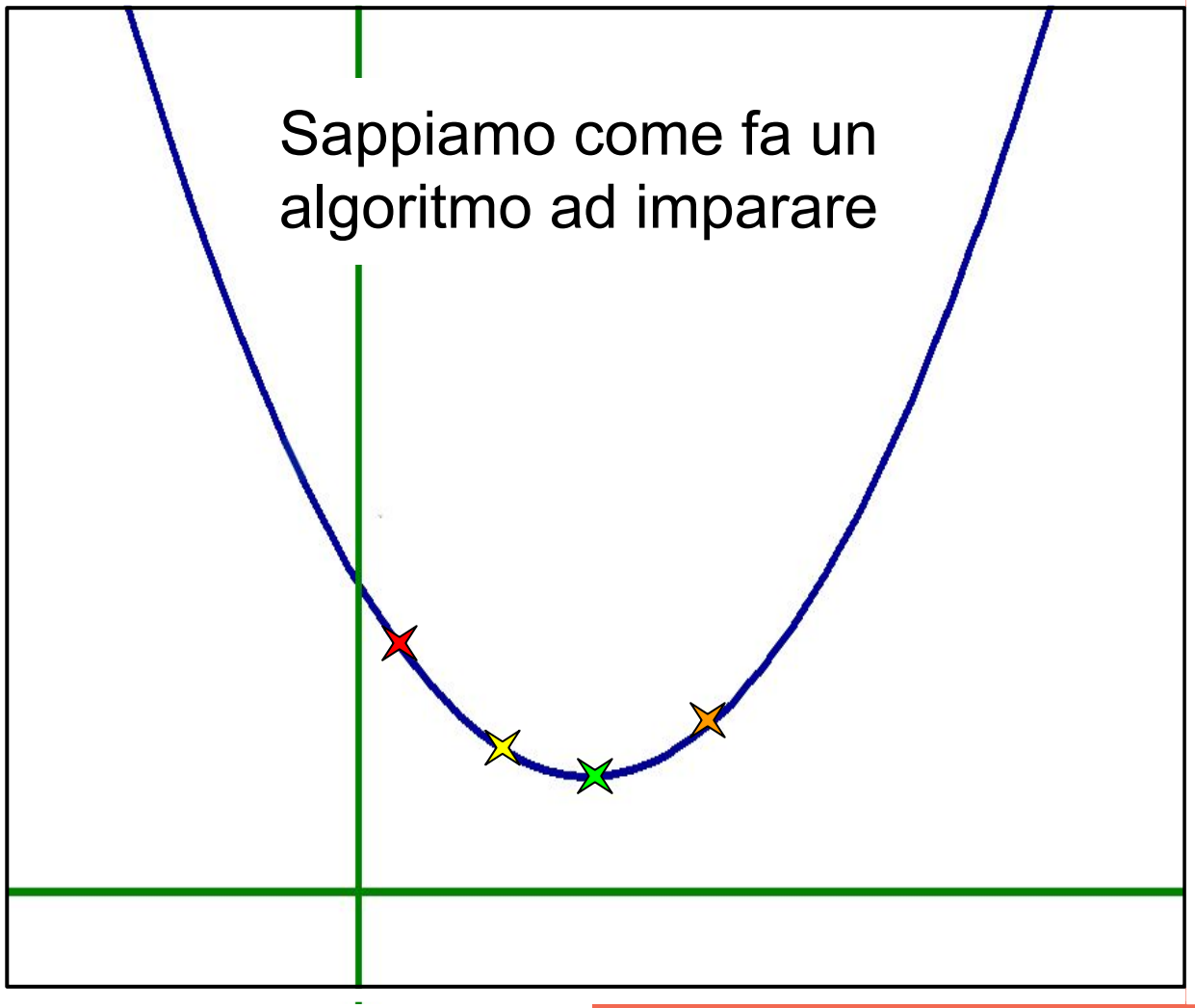

DISTANZA TRA
IPOTESI E REALTA’


ERRORE COMPLESSIVO:
mean square error


Y = m * X
(retta dall'origine)
m ~ 3
m ~ 4/3
m ~ 3/4
m ~ 1/2


errore
pendenza della retta

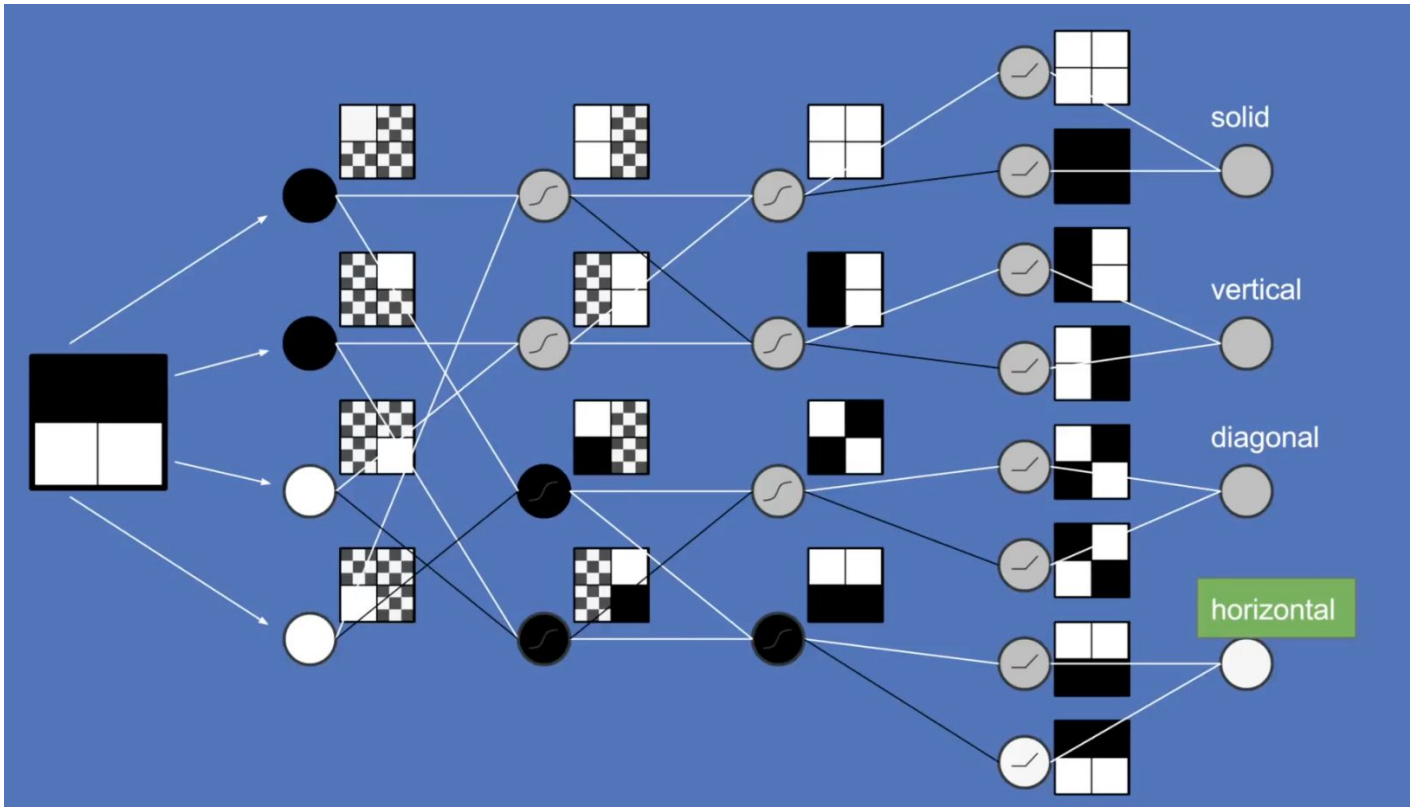

errore
pendenza della retta
valore ottimale


Sappiamo come fa un
algoritmo ad imparare

ML è un problema di ottimizzazione

- ➔ Trovi un problema da risolvere
- ➔ Recuperi più **dati** possibile
- ➔ Identifichi quale può essere una **funzione d'errore** che se minimizzata risolve il tuo problema
- ➔ Vai di **addestramento** e tanta **pazienza**

Reti neurali - MAGIA?



How Deep Neural Networks Work - Brandon Rohrer

REGOLE

nodo nero: negativo
nodo bianco: positivo
nodo grigio: zero

retta bianca: * 1
retta nera: * -1

Sigmoide:

IN: + e -
OUT: -

IN: - e -
OUT: -

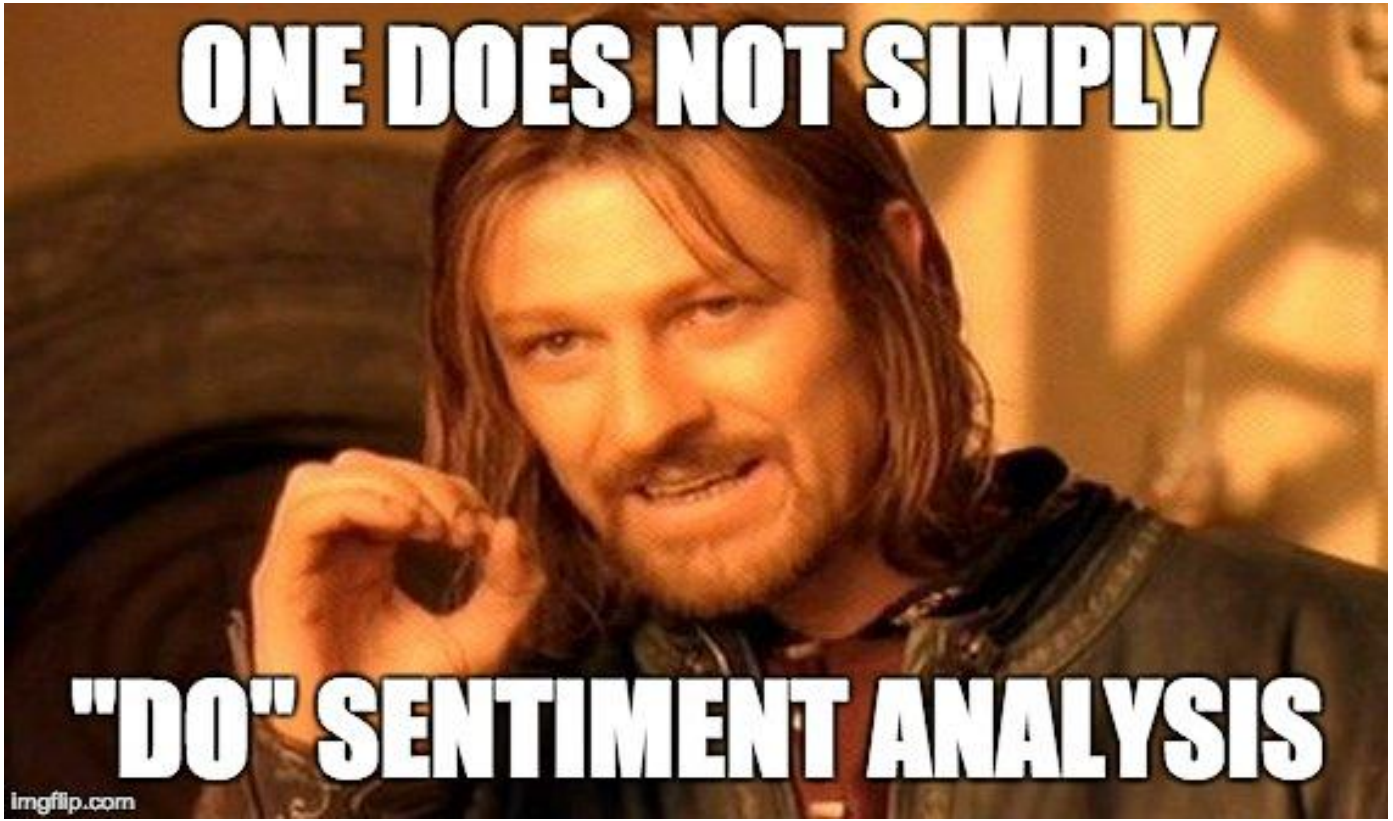
IN: - e +
OUT: zero

ReLU:

IN: +
OUT: +

IN: -
OUT: 0

caso d’uso:
sentiment analysis commenti


ONE DOES NOT SIMPLY
"DO" SENTIMENT ANALYSIS
imgflip.com

Come procedere: i 7 passi

- ➔ recuperare i dati*
- ➔ pulire e preparare i dati*
- ➔ scegliere un modello per stabilire una baseline
- ➔ addestramento del modello*
- ➔ valutazione
- ➔ tuning degli iperparametri
- ➔ predizione

OBIETTIVO: aumentare l'**accuratezza**

Classificare il testo

Lexicon + algoritmo di ML

- divisione in parole (token)
- pulizia
- words embeddings (Bag of words o Tf-idf)
- punteggio emozionale della frase in base alle parole presenti
- addestramento modello statistico

Deep neural networks

- divisione in parole
- pulizia
- words embeddings Word2Vec
- addestramento RNN

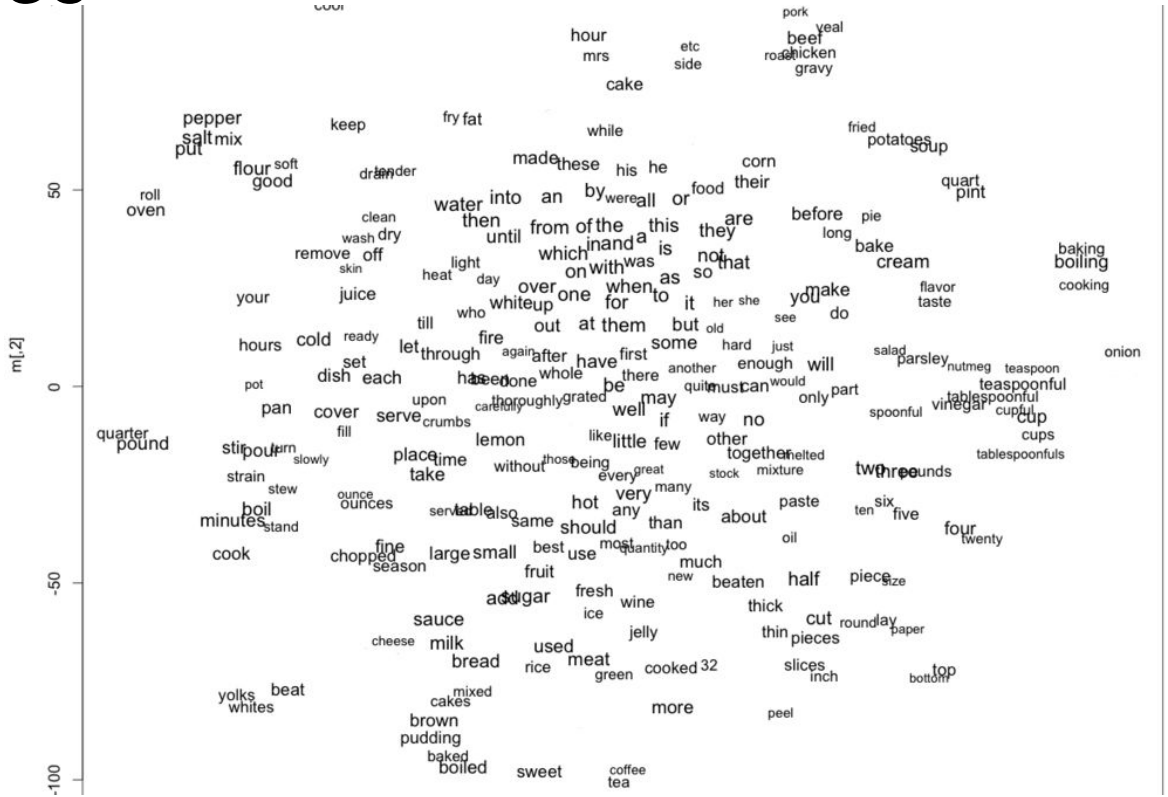
oppure

- divisione del testo in caratteri
- convoluzione per estrazione features
- addestramento CNN

Bag of words

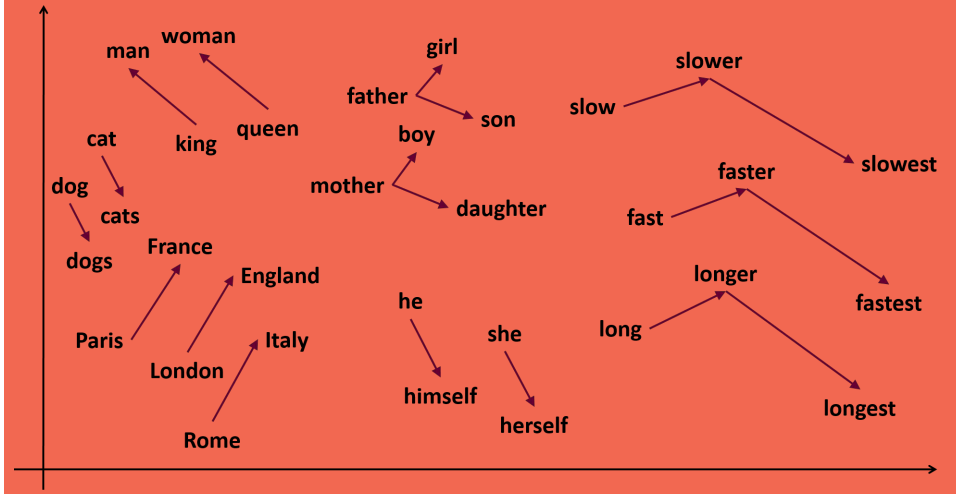
Parola	**Occorrenze**
Polemica	5
Lavoratori	5
Cacciare	4
Contratto	3
Sciopero	2
Chiusura	2

Word2vec


m[,2]
50
0
-50
-100
pork
veal
hour
beef
mrs
etc
side
roast
chicken
gravy
cake
pepper
salt
mix
put
keep
fry
fat
while
fried
potatoes
soup
made
these
his
he
corn
flour
soft
good
drain
colander
their
quart
pint
roll
oven
water
into
an
by
were
all
or
food
clean
then
from
of
the
this
they
are
before
pie
wash
dry
until
a
in
is
long
bake
baking
remove
off
skin
heat
light
day
which
was
not
that
cream
boiling
on
with
as
so
your
juice
over
when
to
it
her
she
you
make
flavor
taste
cooking
white
up
one
for
who
see
do
till
out
at
them
but
old
hours
cold
ready
fire
let
through
again
after
have
first
some
hard
just
salad
parsley
nutmeg
teaspoon
onion
set
dish
each
pot
done
whole
be
there
another
enough
will
quite
must
can
would
only
part
teaspoonful
tablespoonful
vinegar
upon
carefully
thoroughly
grated
may
well
if
way
no
spoonful
cupful
cup
pan
cover
serve
crumbs
fill
like
little
few
other
cups
quarter
pound
stir
pour
lemon
together
melted
tablespoonfuls
slowly
place
time
without
those
being
every
great
stock
mixture
two
three
pounds
strain
take
stew
ounce
ounces
very
many
hot
any
its
paste
six
ten
five
boil
minutes
stand
table
also
same
should
than
about
oil
four
twenty
cook
chopped
fine
large
small
best
use
most
quantity
too
season
much
fruit
new
beaten
half
piece
size
add
sugar
fresh
wine
thick
sauce
ice
cut
round
lay
paper
cheese
milk
jelly
thin
pieces
used
bread
rice
meat
green
cooked
32
slices
inch
top
bottom
yolks
beat
whites
mixed
cakes
more
peel
brown
pudding
baked
boiled
sweet
coffee
tea

Word2vec

Paris - France + Italy = Rome
King - Man + Woman = Queen
Long - Longer + Fast = Faster
Minotaur - Maze + Dragon = Simcity



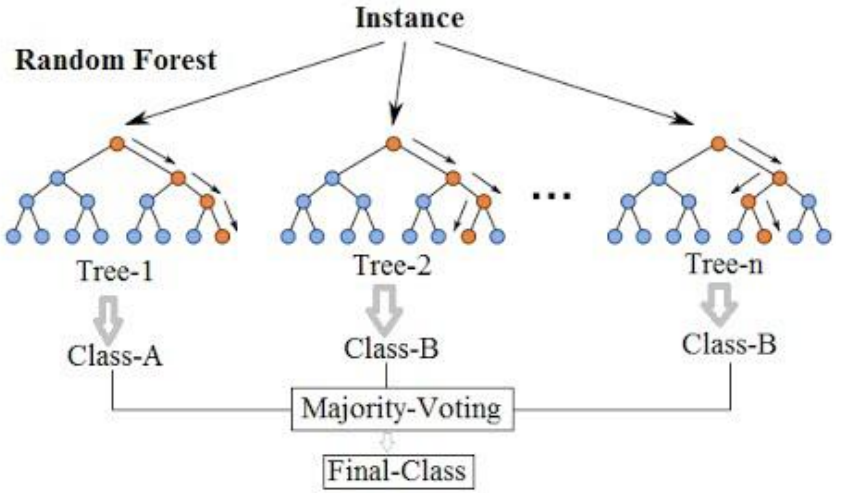
Random forest

Pregi:

- sia classificazioni che regressioni
- gestisce buchi nei dati
- difficile che vada in **overfit**
- gestisce grandi dataset con tanti features

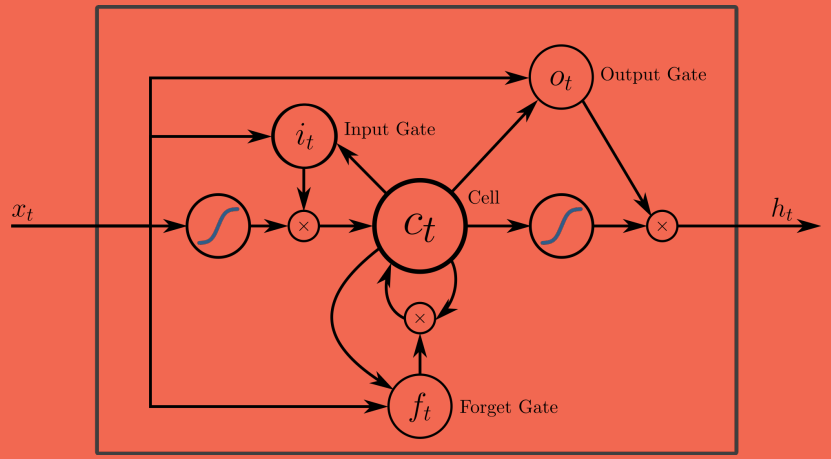
Difetti:

- bravo come classificatore, meno come regressore
- poco controllo su cosa fa il modello



RNN con celle LSTM

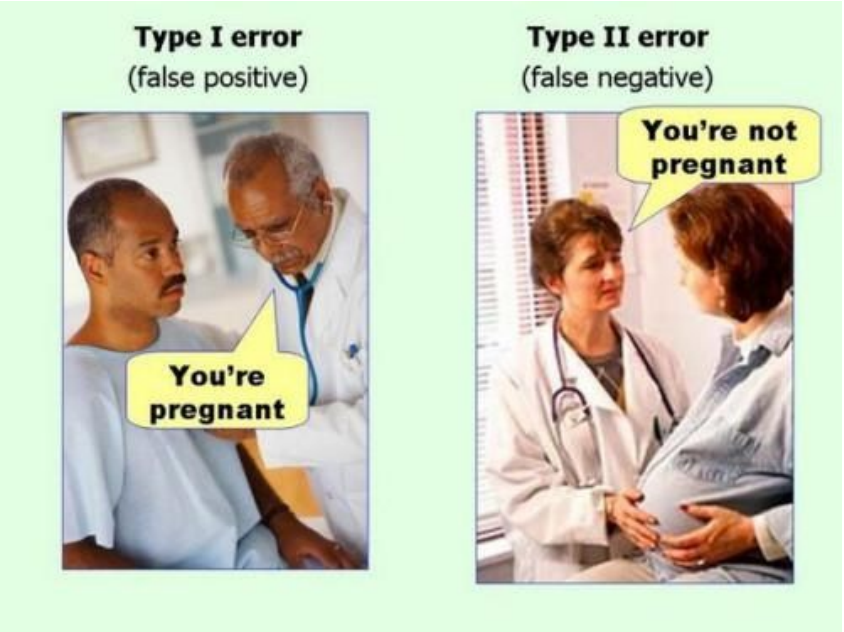
Al posto di un solo valore, le celle contengono un micro algoritmo che può tenere a mente valori per lungo tempo



Risultati

Accuratezza:

- ➔ **Logistic regression:** 72%
- ➔ **Stochastic Gradient Descent:** 75%
- ➔ **Random forest:** 87,2%
- ➔ **Word2Vec + RNN**: 79,3% (poche epoche)
- ➔ **CNN**: esperimento in corso



la startup dei video?

Ultimamente su questi schermi

- Watson di IBM **diagnostica** velocemente anche il tumore **più raro**

- E’ partita la corsa all’uso del **Computer-aided Drugs Discovery**

- Facebook ha un modello in grado di **sostenere una trattativa** e uno persino in grado di **mentire**

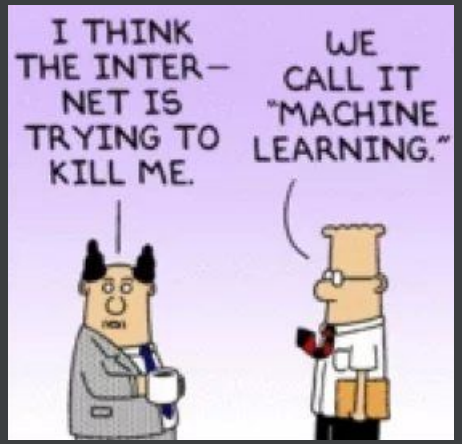
- 6 mesi fa, Dabi Ahn, un giovane ricercatore coreano, mette online un modello che **parla** con la voce di **Kate Winslet**

- a gennaio è nato il fenomeno **Deep Fakes**


Source Actor
Real-time Reenactment
Reenactment Result
Target Actor

*

grazie


I THINK THE INTER— NET IS TRYING TO KILL ME.
WE CALL IT "MACHINE LEARNING."

Via con le domande