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Assignment 1 (Exercise 1.1, 1.3, & 1.6)

1.1

a) Medical diagnosis

X — medical history & symptoms

y — disease \ sickness

$f: X \rightarrow y$ — formula to find out what illness the
patient has

Data set — patient medical history & symptoms

b) Handwritten digit recognition

X — handwritten digits

y — correct digit(s) that were written (0-9)

$f: X \rightarrow y$ — formula to correctly distinguish a digit
from a person's handwriting

Data set — handwritten digits & their match

c) Spam email

X — Email information

y — Email is spam or Email is not spam

$f: X \rightarrow y$ — formula to identify if an email is
spam

Data set — spam email & regular email examples

d) Electric load variations

X — Electric load price, temperature, & day of the week

Y — Electric load variation

f: X→Y — formula to find electric load variation based on its price, temperature, & day of the week

Data set — previous electric loads with the price, temperature, & day of the week they had

e) Problem of interest

X — pictures of vehicles

Y — types of vehicles

f: X→Y — function that can distinguish the different types of vehicles (truck, car, plane, RV, 4-wheeler) from the pictures

Data set — pictures of correctly matched vehicles

1.3

a) Show $y(t) w^T(t) x(t) < 0$

If $x(t)$ is misclassified by $w(t)$, then $w^T(t) x(t) \neq y(t)$ so they have different signs & are less than 0.

$$w(t+1) = w(t) + y(t)x(t)$$

b) Show $y(t)w^T(t+1)x(t) > y(t)w^T(t)x(t)$

$= y(t)(w(t) + y(t)x(t))^T x(t)$

$= y(t)(w^T(t) + y(t)x^T(t))x(t)$

$= y(t)w^T(t)x(t) + y^2(t)x^T(t)x(t) > y(t)w^T(t)x(t)$

$-y(t)w^T(t)x(t)$ .... $- y(t)w^T(t)x(t)$

$= \boxed{y^2(t)x^T(t)x(t) > 0}$

c) Moving from $w(t)$ to $w(t+1)$ is a move in the right direction because if $y^2(t)$ is positive, $x^T(t)x(t)$ will be positive & if $y^2(t)$ is negative, $x^T(t)x(t)$ will be negative.

1.6

a) Recommending a book to a user
Learning type(s) — Unsupervised learning
Training Data — Previously read books from the user (to learn preferences)

b) Tic-tac-toe
Learning type(s) — Unsupervised learning
Training Data — Previous rounds of played tic-tac-toe & the grade for each output

c) (Categorizing movies)

Learning type(s) — Unsupervised learning
Training Data — Different movies & their
genre classifications (to find
patterns)

d) Learning to play music

Learning type(s) - Supervised, Reinforcement, or Unsupervised
Training data -

- Supervised learning: A human can
babysit an algorithm & feed
it correct notes & tunes for
songs

- Reinforcement learning: A human can
can feed different notes &
tunes for a song with a
measure of how good the
song is

- Unsupervised learning: Songs can be
passed to an algorithm along
with their popularity so it
can learn what sounds people
like

e) Credit limit

Learning type(s) - Supervised learning
Training Data - Customer record (salary, loans, etc)