ARTIFICIAL NEURAL NETWORKS

NOW COMING BACK TO OUR BASIC PROBLEM - HOW DOES THE SUPPORT VECTOR MACHINE FIND THE "BEST" HYPERPLANE TO SEPARATE THE 2 SETS OF POINTS?

THE SOLUTION IS CALLED
THE MAXIMUM MARGIN HYPERPLANE

INTUITIVELY, THE "BEST" HYPERPLANE IS ONE THAT:

MAXIMIZES SUM OF THE DISTANCES OF THE NEAREST POINTS ON EITHER SIDE

OBJECTIVE FUNCTION

CONSTRAINTS
(WHILE STILL MAKING SURE THAT ALL POINTS OF ONE TYPE ARE ON ONE SIDE OF THE PLANE AND ALL POINTS OF THE OTHER ARE ON THE OTHER)

THIS IS SET UP BEAUTIFULLY AS AN OPTIMIZATION PROBLEM

WE WON'T GO INTO THE DETAILS OF HOW EXACTLY THAT OPTIMIZATION PROBLEM IS FRAMED MATHEMATICALLY OR SOLVED -

BUT SUFFICE IT TO SAY THAT IT CAN BE CONVERTED INTO A FAIRLY STANDARD QUADRATIC PROGRAMMING PROBLEM FOR WHICH STANDARD SOLUTION TECHNIQUES EXIST

THE MAXIMUM MARGIN HYPERPLANE

IS FOUND - AND BTW THE "SUPPORT VECTORS" ARE SIMPLY THE "NEAREST POINTS" ON EACH SIDE - WHICH "SUPPORT" THE HYPERPLANE

NOW ALL OF THIS WAS ABOUT SUPPORT VECTOR MACHINES, BUT ALSO APPLIED TO

PERCEPTRONS

NOW ALL OF THIS WAS ABOUT
SUPPORT VECTOR MACHINES, BUT
ALSO APPLIED TO

PERCEPTRONS

A PERCEPTRON IS A SPECIFIC ALGORITHM
FOR DETERMING SOME HYPERPLANE THAT
SEPARATES DATA OF TWO CATEGORIES

THIS SPECIFIC ALGORITHM IS A DIFFERENT
WAY TO GET SOME - ANY - HYPERPLANE THAT
SEPARATES THE POINTS

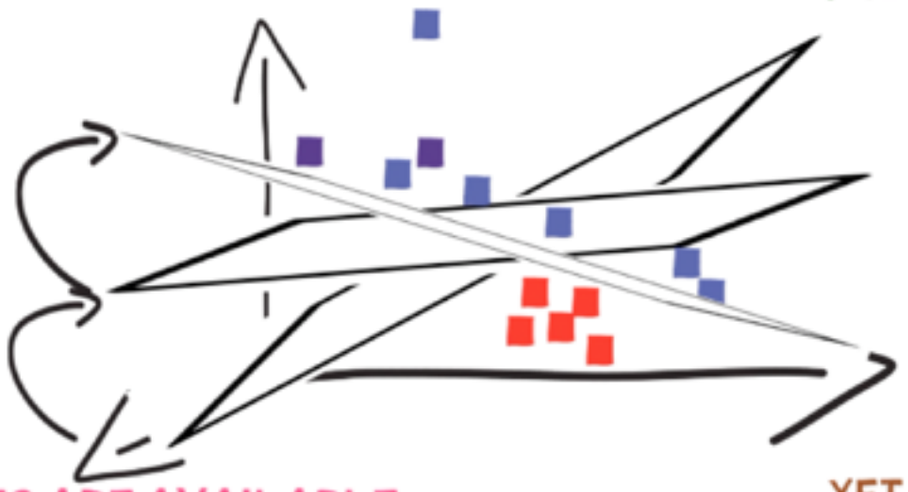
THE SUPPORT VECTOR MACHINE
FINDS THE "BEST" SUCH HYPERPLANE,
NAMELY THE MAXIMUM MARGIN
HYPERPLANE

WHILE THE PERCEPTRON WILL MERELY
ATTEMPT TO FIND ONE SUCH HYPERPLANE

THE PERCEPTRON IS SAID TO USE

"ONLINE LEARNING"

WHICH IS A SPECIFIC TERM IN MACHINE LEARNING USED TO DENOTE TECHNIQUES WHERE THE TRAINING DATA IS CONSUMED ONE POINT AT A TIME



TWO DATA POINTS ARE AVAILABLE, THE PERCEPTRON FINDS ONE HYPERPLANE THAT CORRECTLY CLASSIFIES THESE TWO

A NEW DATA POINT COMES IN, AND THE PERCEPTRON MOVES THE PLANE ACCORDINGLY

(THE PLANE IS MOVED IN A WAY SO THAT THE A QUANTITY CALLED THE ITERATION ERROR IS REDUCED - NEVER MIND THE MECHANICS)

YET ANOTHER DATA POINT IS ADDED, AND YET ANOTHER ADJUSTMENT TO THE SEPARATING HYPERPLANE

THE PERCEPTRON WILL CONVERGE TO SOME SOLUTION IN A FINITE NUMBER OF STEPS SO LONG AS THE DATA IS LINEARLY SEPARABLE