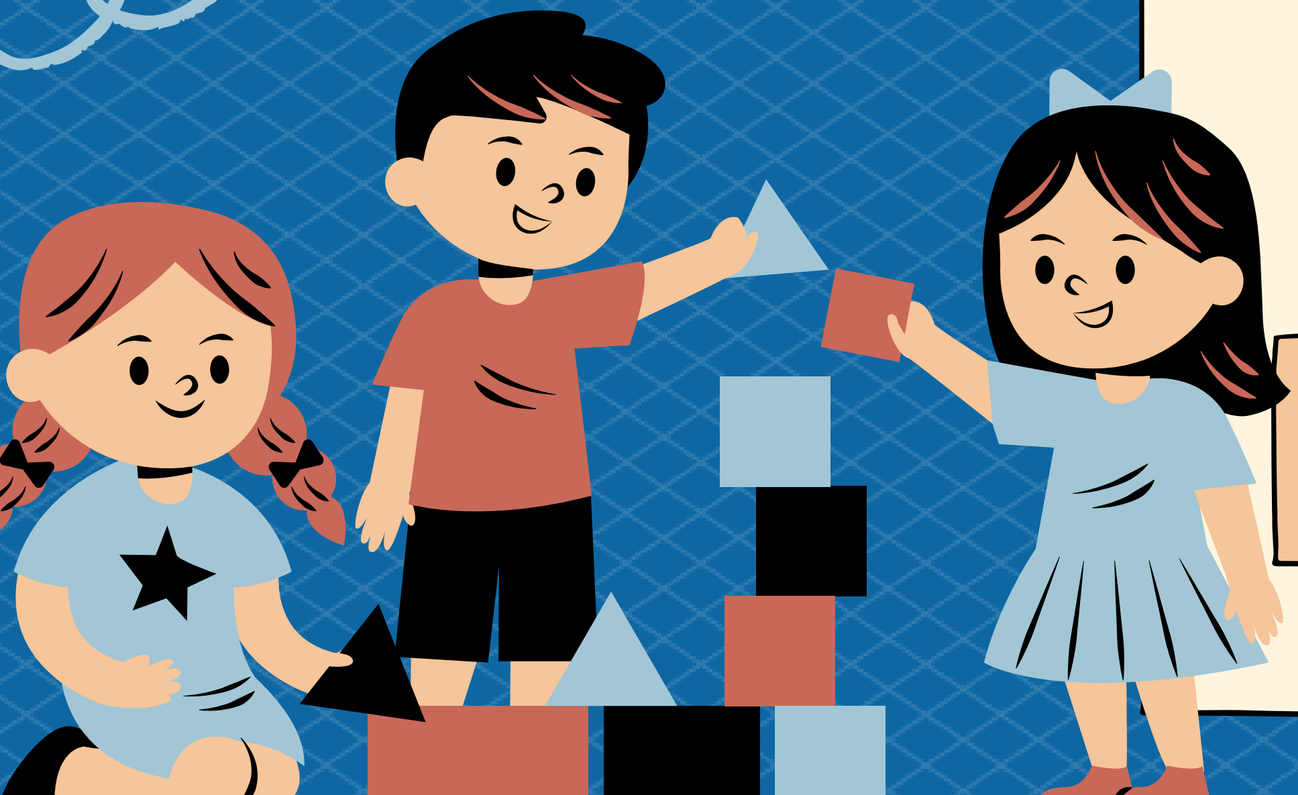
BY
RISHABH SINGH

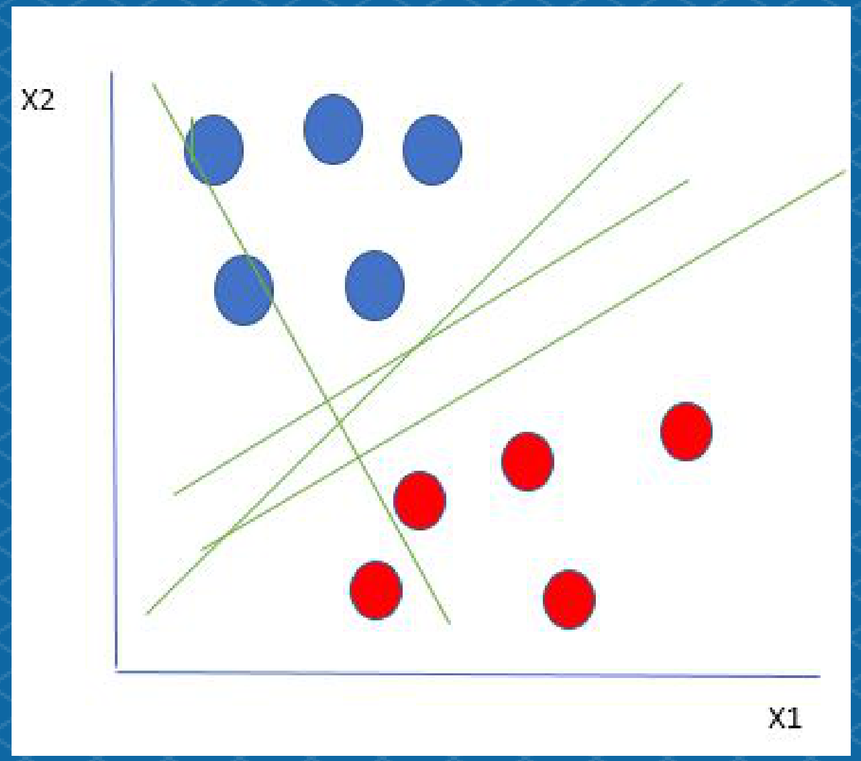


scikit learn

SVM

Support Vector Machine

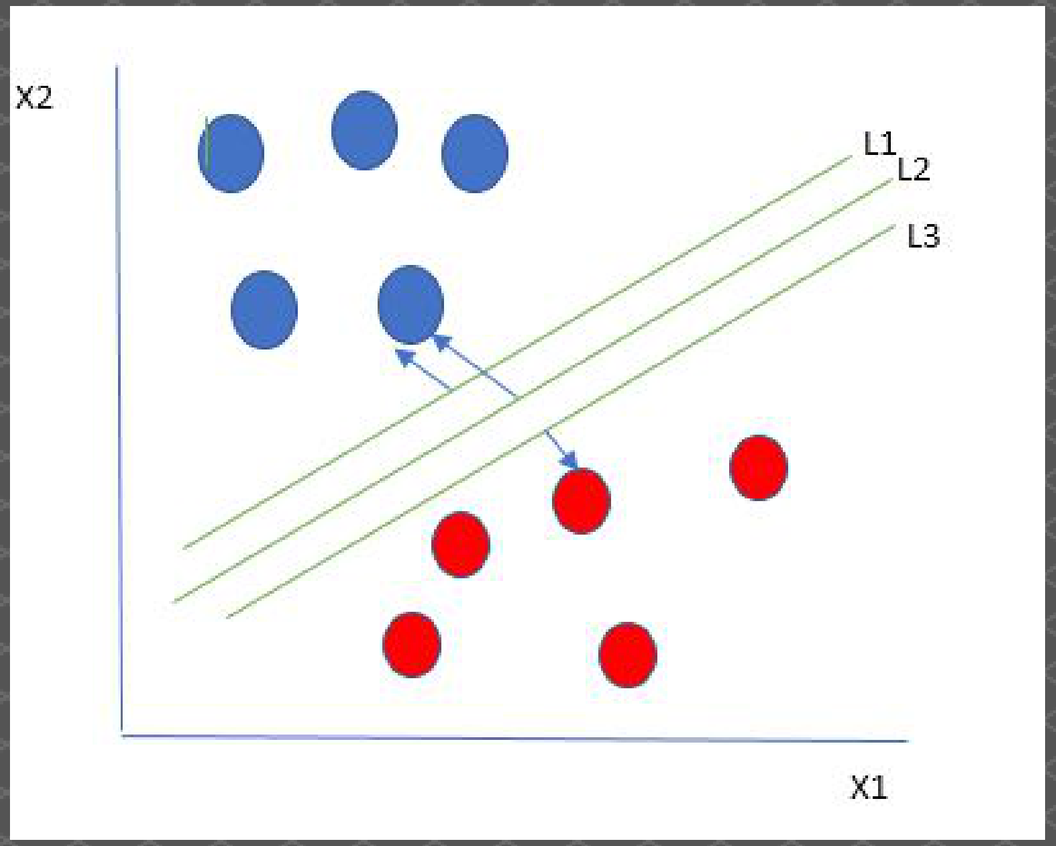
SUPPORT VECTOR MACHINE (SVM) IS A POWERFUL MACHINE LEARNING ALGORITHM USED FOR LINEAR OR NONLINEAR CLASSIFICATION, REGRESSION



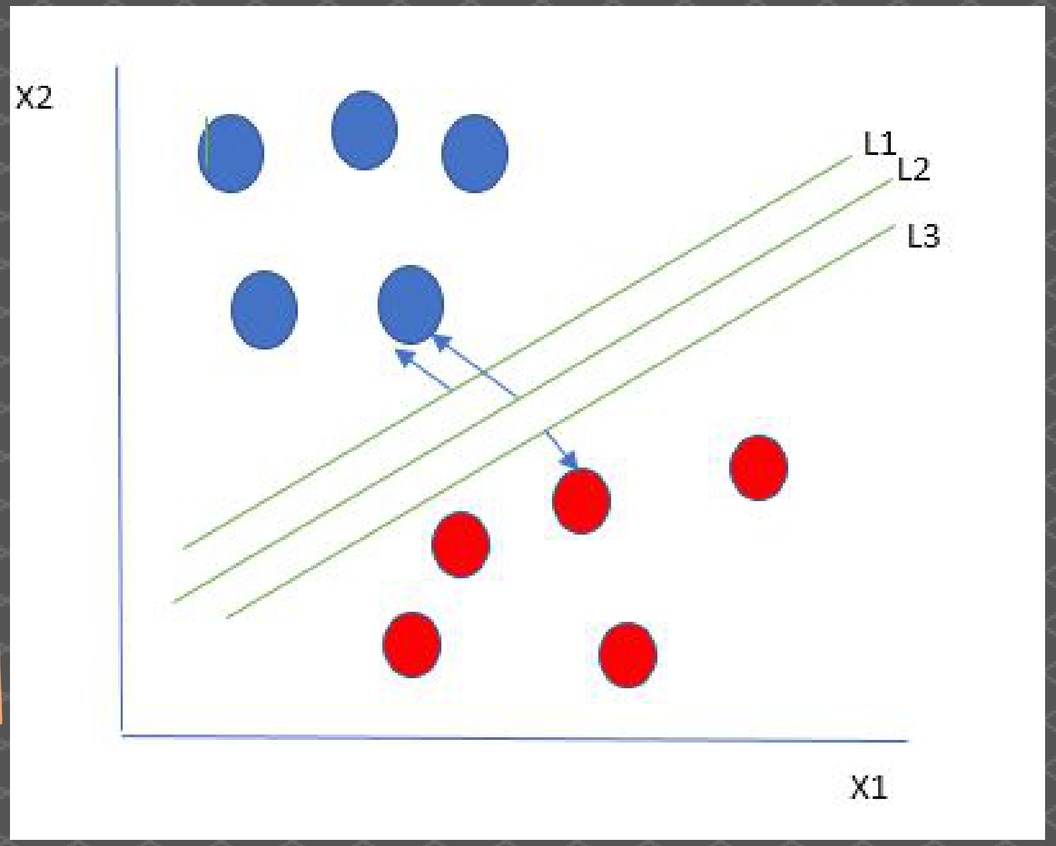
GREEN LINE IN IMAGE ARE CALLED MARGIN

- L1 - SOFT MARGIN
- L-2 HARD MARGIN
- L-3 SOFT MARGIN

POINTS NEAREST TO MARGIN ARE CALLED SUPPORT VECTOR, HENCE SUPPORT VECTOR MACHINE



WE CHOOSE THE MARGIN WHOSE DISTANCE FROM IT TO THE NEAREST DATA POINT ON EACH SIDE IS MAXIMIZED. IF SUCH A MARGIN EXISTS IT IS KNOWN AS THE MAXIMUM-MARGIN /HARD MARGIN.

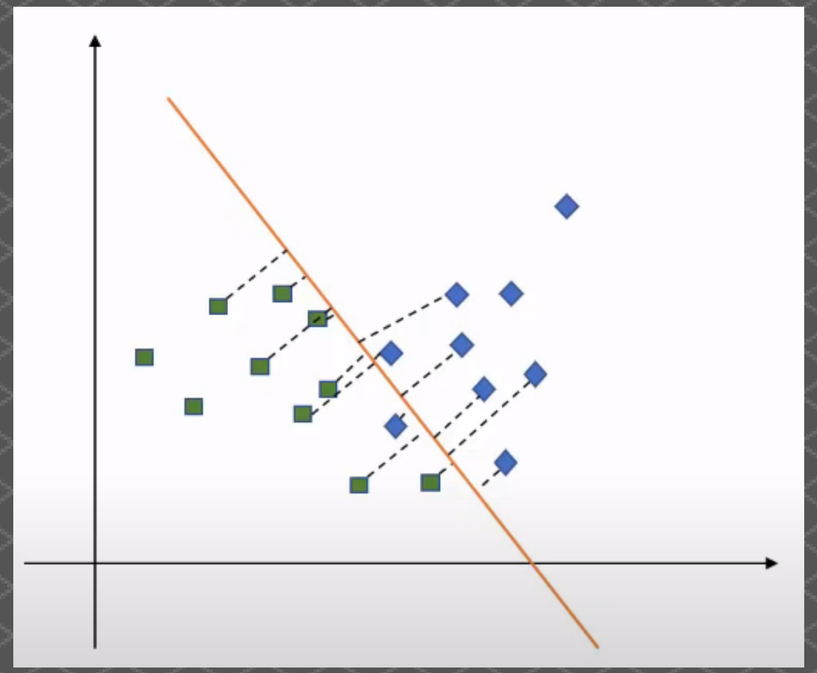


CHOOSE ACCORDINGLY

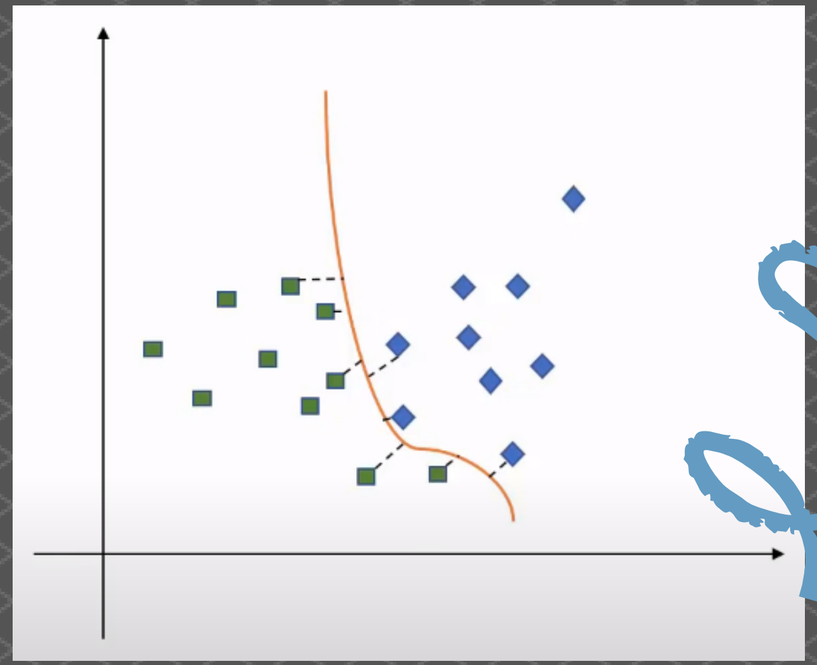
DEPENDING ON USE CASE WE CAN CHOOSE VALUE OF GAMMA AND REGULARIZATION(C) TO FIND THE MARGIN

IN CASE OF OUTLIER AND COMPLEX DATA SET CHOOSING HIGH REGULARIZATION(C) AND GAMMA CAN LEAD TO OVER-FITTING

Low Regularization Low Gamma



High Regularization High Gamma

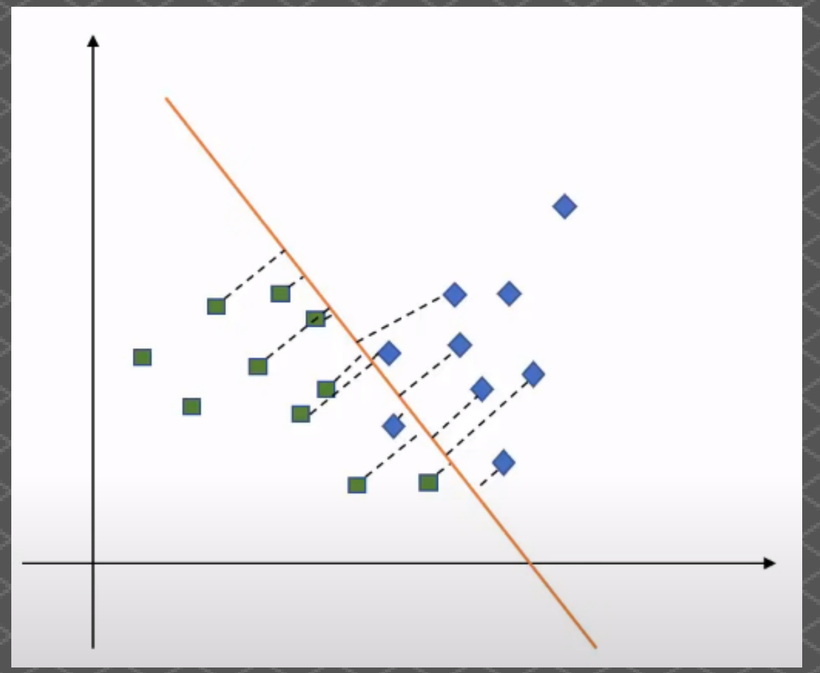


REGULARIZATION VS GAMMA

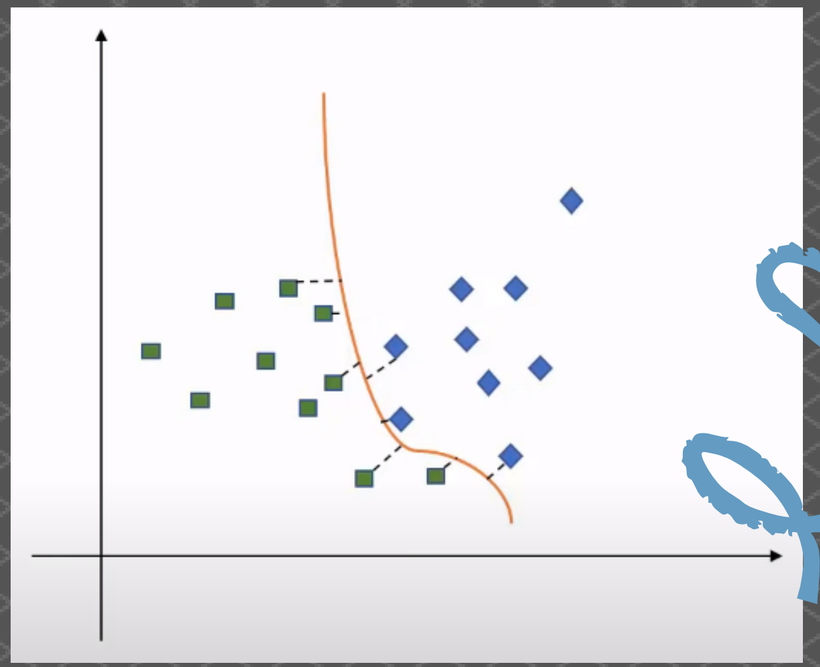
- HIGH REGULARIZATION AND GAMMA REQUIRES MORE COMPUTATIONAL POWER
- GAMMA INFLUENCES SHAPE OF THE MARGIN, IMPORTANT IN CASE OF NON-LINEAR SVMS USING (SIGMOID, POLY OR RBF KERNEL)
- REGULARIZATION(C) CONTROLS TRADE-OFF BETWEEN MAXIMIZING THE MARGIN AND MINIMIZING THE CLASSIFICATION ERROR. PREVENTS OVERFITTING BY PENALIZING THE MISCLASSIFICATION OF TRAINING EXAMPLES.

CHOOSE ACCORDINGLY

High Regularization Low Gamma



High Gamma



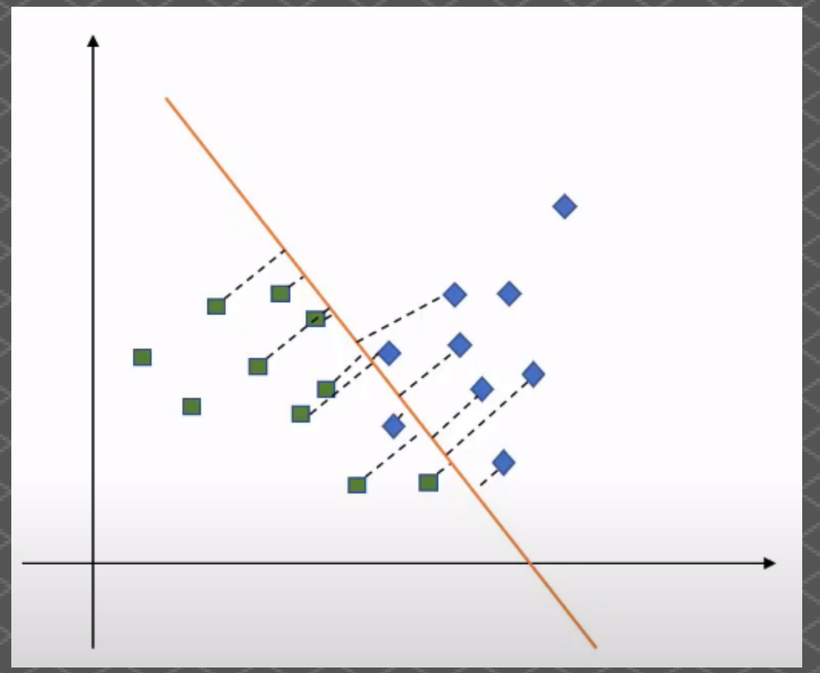
REGULARIZATION VS GAMMA

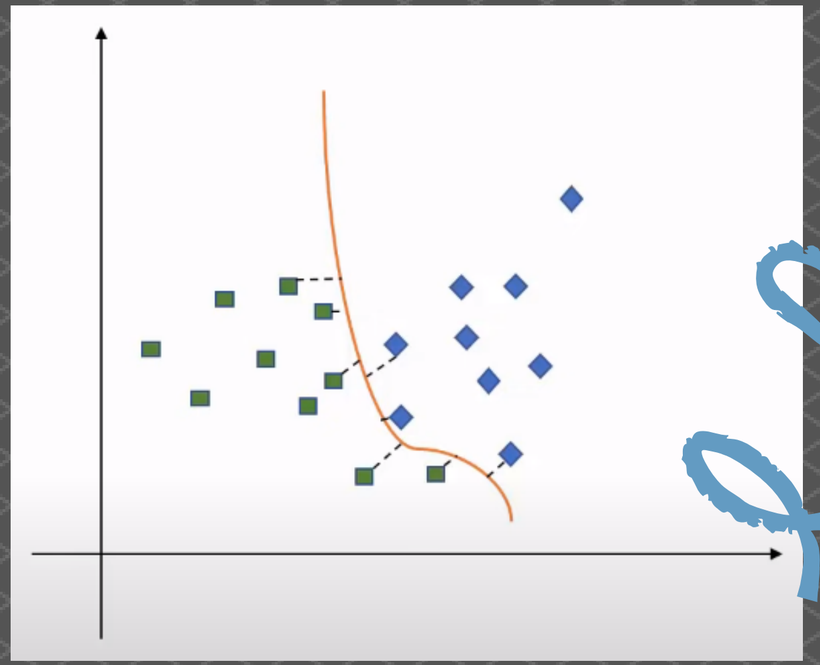
IN SUMMARY, GAMMA CONTROLS THE FLEXIBILITY OF THE DECISION BOUNDARY IN NON-LINEAR SVMS, WHILE C CONTROLS THE REGULARIZATION STRENGTH, INFLUENCING THE TRADE-OFF BETWEEN MAXIMIZING THE MARGIN AND MINIMIZING TRAINING ERRORS. THE APPROPRIATE VALUES FOR GAMMA AND C DEPEND ON THE NATURE OF THE DATA AND THE GOALS OF THE MACHINE LEARNING TASK, AND THEY OFTEN REQUIRE TUNING.

CHOOSE ACCORDINGLY

High Regularization Low Regularization

High Gamma Low Gamma





$$\text{Linear}: K(w,b) = w^T x + b$$
$$\text{Polynomial}: K(w,x) = (\gamma w^T x + b)^N$$
$$\text{Gaussian RBF}: K(w,x) = \exp(-\gamma ||x_i - x_j||^n$$
$$\text{Sigmoid}: K(x_i, x_j) = \tanh(\alpha x_i^T x_j + b)$$

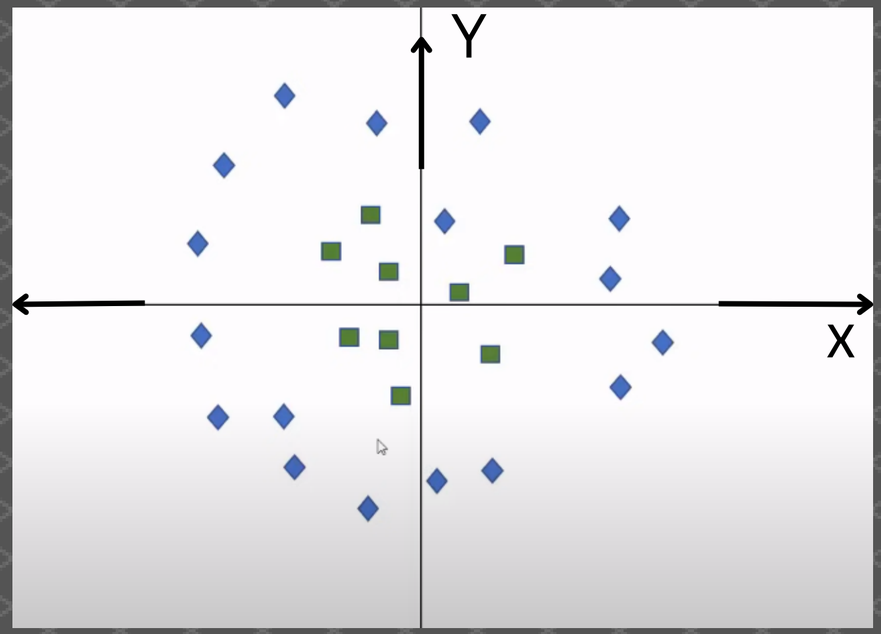
KERNELS

KERNEL IS A SPECIAL MATHEMATICAL TOOL THAT HELPS SVM'S MAKE SENSE OF DATA THAT ISN`T ORGANIZED NEATLY IN A STRAIGHT LINE. IT TRANSFORMS THIS MESSY DATA INTO A FORMAT THAT`S EASIER FOR THE SVM TO UNDERSTAND. THIS TRANSFORMATION MAKES IT POSSIBLE FOR THE SVM TO FIND THE BEST WAY TO SEPARATE DIFFERENT GROUPS OF DATA POINTS, EVEN IF THEY`RE ALL JUMBLED UP IN THE ORIGINAL DATA. SO, KERNELS HELPS IN FIND THE DIVIDING LINE BETWEEN DIFFERENT GROUPS.

CHOOSE ACCORDINGLY

THIS IS A NON-LINEAR DATA FOR THIS WE ARE GOING TO USE KERNEL. THAT IS A CUSTOM KERNEL

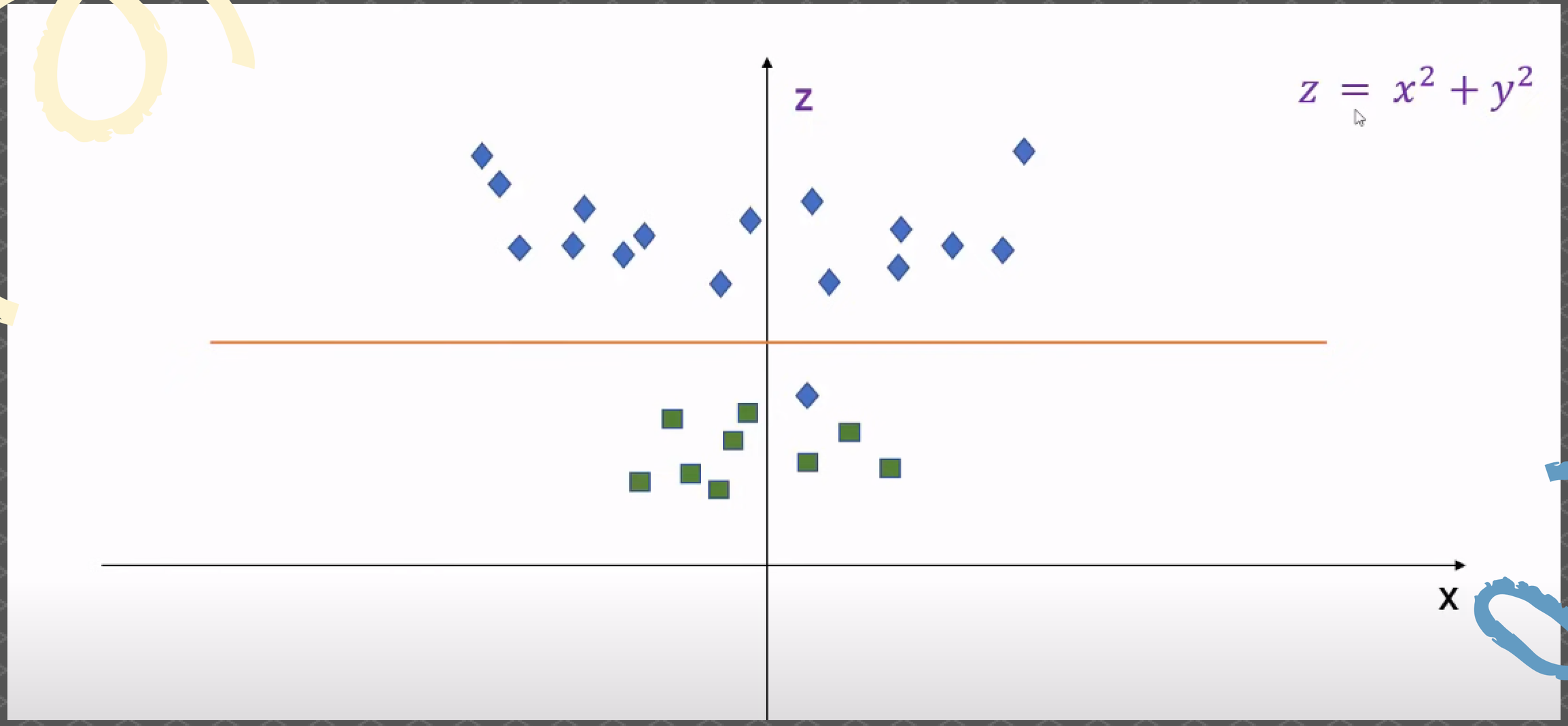
$$Z = X^2 + Y^2$$



Z IS THE KERNEL NOW DATA WILL LOOK LIKE THIS

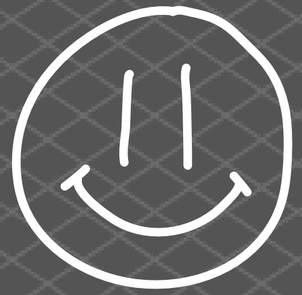
CHOOSE ACCORDINGLY

CHOOSE ACCORDINGLY



THIS TRANSFORMATION IS CALLED KERNEL

THAT'S IT FROM MY SIDE



THANK YOU