Machine Learning for Maths - Session 2 Summary

What is a Vector (x)?

- An entity which has both magnitude and direction.
- A line drawn from the origin (0,0) to a data point is a vector.
- Data structures like list, tuple, numpy array, or pandas Series can represent vectors.
- In Python (and ML), vectors are treated as column vectors unless stated otherwise.

Distance Between Two Points

1. Euclidean Distance (L2 Norm):

   sqrt((x2 - x1)^2 + (y2 - y1)^2)

2. L2 Norm (Euclidean Norm):

   sqrt((0 - x1)^2 + (0 - y1)^2) = sqrt(x1^2 + y1^2)

3. L1 Norm (Manhattan Norm):

   |x1| + |y1|

Dot Product of Vectors

- Given two vectors x and y, the dot product is x^T * y.
- The result is always a scalar.

Dot Product Intuition

- If angle theta < 90 degrees Dot Product is positive
- If 90 < theta < 180 degrees Dot Product is negative
- If theta = 90 degrees Dot Product = 0 (vectors are perpendicular)
- If theta = 0 degrees Vectors point in the same direction

Unit Vector

- A vector with magnitude = 1.
- Often used to define direction without considering length.

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Important Points

- Any classifier can be modified using weights and bias.
- The weight vector is always perpendicular to the classifier boundary.