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Generalized Approach to Linear Data Transformation

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Abstract : This paper presents a generalized approach for the simple linear data transformation, Y=bX, through an integration of multidimensional coordinate geometry, vector space theory and polygonal geometry. The scaling is performed by adding an additional 'Dummy Dimension' to the n-dimensional data, which helps plot two dimensional component-wise straight lines on pairs of dimensions. The end result is a set of scaled extensions of observations in any of the 2n spatial divisions, where n is the total number of applicable dimensions/dataset variables, created by shifting the n-dimensional plane along the 'Dummy Axis'. The derived scaling factor was found to be dependent on the coordinates of the common point of origin for diverging straight lines and the plane of extension, chosen on and perpendicular to the 'Dummy Axis', respectively. This result indicates the geometrical interpretation of a linear data transformation and hence, opportunities for a more informed choice of the factor 'b', based on a better choice of these coordinate values. The paper follows on to identify the effect of this transformation on certain popular distance metrics, wherein for many, the distance metric retained the same scaling factor as that of the features.

Keywords : data transformation, dummy dimension, linear transformation, scaling
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