Assignment8: Regression and Neural Networks

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Exercise 8.3 (Support Vectors)

1. Give a linear separator in the form $h(\mathbf{x}) = \mathbf{w} \cdot \mathbf{x} + b$ for the dataset without $x5$.

   $h(\mathbf{x}) = (1, 1) \cdot \mathbf{x} - 1$

2. Explain informally why no linear separator exists for the full dataset of all 5 vectors.

   All points belonging to class -1 cannot be separated by a line from points belonging to class 1.

3. Transform the dataset into a 3-dimensional dataset by applying the function $F(\langle u, v\rangle) = \langle u_2, v_2, u + v\rangle$.

   $F(\mathbf{X}) = \{\langle 0, 0, 0\rangle, \langle 0, 0.25, 0.5\rangle, \langle 0.25, 0, 0.5\rangle, \langle 1, 1, 2\rangle, \langle 4, 4, 4\rangle\}$

4. Give a linear separator for the transformed full dataset in the form $h(\mathbf{x}) = \mathbf{w} \cdot \mathbf{x} + b$.

   $h(\mathbf{x}) = (-1, -1, 2) \cdot \mathbf{x} - 1$