1 Philosophy

- Learning algorithms are to compute parameters while complexity analysis focuses on distinguishing different functions from some concept class.

2 Weak SQ Dimension

Definition 2.1. The (weak) SQ dimension of a class of real valued functions $\mathcal{F}$ over some domain X under distribution $\mathcal{D}$, denoted $\mathrm{SQDim}_{\mathcal{F}}^{\mathcal{D}}$, is the biggest d such that $\mathcal{F}$ contains distinct $f_1, \cdots, f_d$ with pairwise correlations between $-\frac{1}{d}$ and $\frac{1}{d}$. Note that correlation between f and g is defined by

$$\langle f, g \rangle \triangleq \mathbb{E}_{x \sim \mathcal{D}} f(x) g(x) .$$

Example 2.2. When consider $\mathcal{F}$ as set of vectors on S^{n-1}, inner product as standard inner product and $\mathcal{D}$ as uniform distribution, SQDim is now polynomial; while SQDim is 2^n for parity functions under uniform distribution.