$$h_{ij} = \frac{\partial^2 E}{\partial w_i \partial w_j} = \langle x_i x_j \rangle = \frac{1}{m} \sum_p x_i^{(p)} x_j^{(p)}$$

$$\hat{x} = x + \begin{pmatrix} 1000 \\ \cdots \\ \cdots \\ 1000 \end{pmatrix} \qquad \begin{pmatrix} 1000 \\ \cdots \\ \cdots \\ 1000 \end{pmatrix} = \mathbf{1000}$$

$$\tilde{H} = \langle \hat{\tilde{x}} \hat{\tilde{x}}^T \rangle = \langle (x + \mathbf{1000})(x + \mathbf{1000})^T \rangle$$
$$= \langle x x^T \rangle + \cancel{\langle x \rangle \mathbf{1000}^T} + \cancel{\mathbf{1000} \langle x^T \rangle} + 1000$$

assume $\langle x \rangle = 0$
as there is zero mean.

Make (S) input zero mean and make input unit varience

$$h_{ij} = \frac{\partial^2 E}{\partial w_i^2} = \langle x_i^2 \rangle = \bar{x}^{2} + VAR(x_i)$$

if we have n "experts"

~~$w_i(t)$ = weight for i for t^{th} game (± 1)~~

$w_i(t)$ = weight for expert (i) at time (t)

$x_i(t)$ = prediction for i for t^{th} game (± 1)

$$P(t) = \text{sign}\left(\sum_i w_i(t)\, x_i(t)\right)$$

$z(t) = \pm 1$ winner of game t

$$w_i(t) = \frac{\#\ \text{correct}\ (0 \ldots t-1)}{t}$$

$w_i(t+1) = \ldots \quad w_i(t)$ [continued next lecture]

S = matrix of small numbers.