) Apr 1990 Gradient Descent — Intuitive Pictorial View

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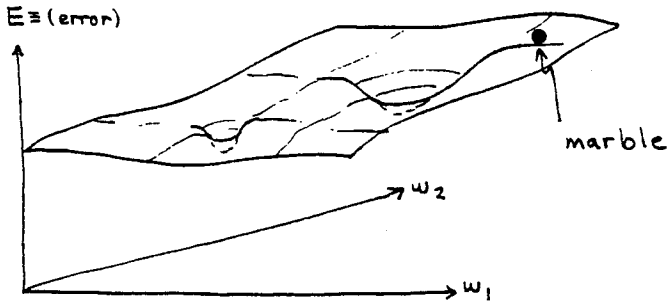


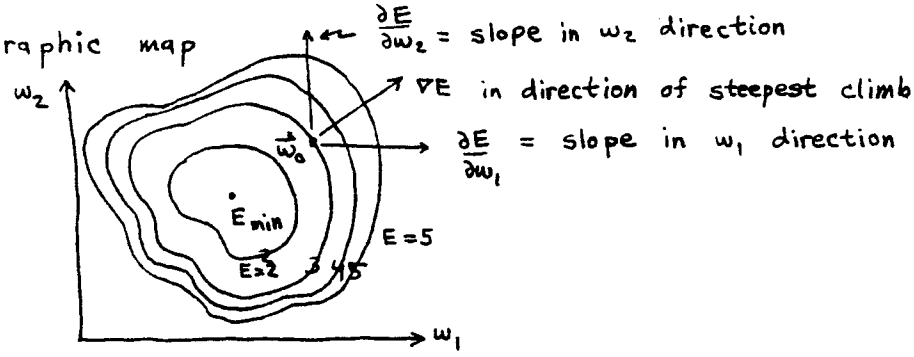
The marble rolls to the bottom of the bowl it starts in. It rolls in the direction of steepest slope, (when it has no momentum).

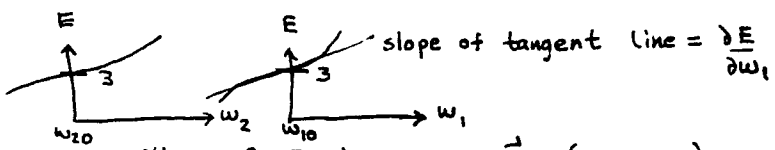
Direction of steepest descent $= -\nabla E(\vec{w})$

where $\nabla E \equiv \left[\begin{array}{c} \frac{\partial E}{\partial w_1} \\ \frac{\partial E}{\partial w_2} \end{array}\right]\Bigg|_{\text{evaluated at } \vec{w}=(w_1,w_2)}$ is gradient of E with respect to $\vec{w}$.

Gradient is vector pointing in direction of steepest slope. $\therefore -\nabla E$ is steepest downhill direction.

ex: topographic map





profiles of $E(\vec{w}_0)$ near $\vec{w}_0 = (w_{10}, w_{20})$

slopes of $\frac{\partial E}{\partial w_1}$ ≈ slope of $\frac{\partial E}{\partial w_2}$ so ∇E at $\approx 45^\circ$

If $\partial E/\partial w_1 = 0$ then ∇E points in w_2 direction.