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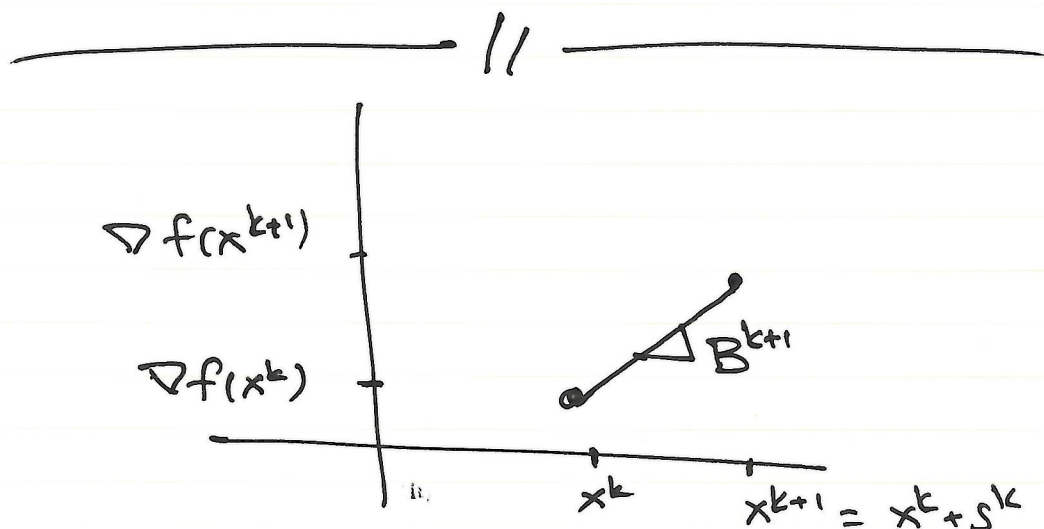
Announcement: Hw4, Q4 due on Monday (Nov 7)

Observe: Suppose $\Delta w = -r'(w)r(w)$

$$r(w + \theta \Delta w) \approx r(w) + r'(w)(\theta \Delta w)$$

$$\approx r(w) + \theta \underbrace{r'(w)\Delta w}_{-r(w)}$$

$$\approx (1 - \theta)r(w)$$



If $B^+ = B + a u u^T$

$$y = \underbrace{B^+}_{\substack{\uparrow \\ \text{secant} \\ \text{eqn.}}} s = B s + a u u^T s = B s + (a u^T s) u$$

Marq quasi-Newton itr

1) Compute $P_{\bullet}^k = -(B^k)^{-1} \nabla f(x^k)$

2) Set $x^{k+1} = x^k + t_k P^k$

3) Update \underline{B}^{k+1}

SR1 update:

$$B^{k+1} = B^k + \frac{(y^k - B^k s^k)(y^k - B^k s^k)^T}{(y^k - B^k s^k)^T s^k}$$

$$s^k = x^{k+1} - x^k \quad y^k = \nabla f(x^{k+1}) - \nabla f(x^k)$$

Special case of SMW

$$(A + uv^T)^{-1} = A^{-1} - \frac{A^{-1}u v^T A^{-1}}{1 + v^T A^{-1}u}$$

Secant eqn

$$B^+ s = y \iff H^+ y = s$$

Observe:

$$\begin{aligned}
 H^T g &= \left(I - \frac{S Y^T}{Y^T S} \right) H \underbrace{\left(I - \frac{Y S^T}{Y^T S} \right) g}_{=} + \frac{S S^T g}{Y^T S} \\
 &= \left(I - \frac{S Y^T}{Y^T S} \right) H \underbrace{\left(g - \frac{S^T g}{Y^T S} y \right)}_p + \underbrace{\frac{S^T g}{Y^T S}}_{\alpha} S \\
 &= \left(I - \frac{S Y^T}{Y^T S} \right) p + \alpha S \\
 &= p + (\alpha - \beta) S \quad \beta = \frac{Y^T p}{Y^T S}
 \end{aligned}$$