(x, y) $\qquad f(x,y) = \begin{bmatrix} x^2 \\ x+y \\ \sqrt{y+x} \end{bmatrix}$ campo vettoriale

$f: \mathbb{R}^2 \to \mathbb{R}^3$

$f(x,y) = x^2 + 0.5y^2 \qquad \nabla f = \left[\frac{\partial f}{\partial x}, \frac{\partial f}{\partial y}\right] = [2x, y]$

$(x, y, \underbrace{f(x,y)}_{1}) \in \mathbb{R}^3$

$\|\nabla f\|^2 = 4x^2 + y^2$

Esempio gradiente

$$f(u,v) = 4\underbrace{(u v^3)}_{g(u,v)}^5 + \ln(u v^3) = 4\, g(u,v)^5 + \ln(g)$$

$$\nabla_f = \left[\frac{\partial f}{\partial u} \quad \frac{\partial f}{\partial v}\right]$$

$$\frac{\partial f}{\partial u} = \frac{\partial f}{\partial g}\frac{\partial g}{\partial u} = 20(u v^3)^4 v^3 + \frac{1}{u v^3} v^3$$

$$\frac{\partial g}{\partial u}$$

$$\left(20(u v^3) + \frac{1}{u v^3}\right) v^3$$

regola la catena

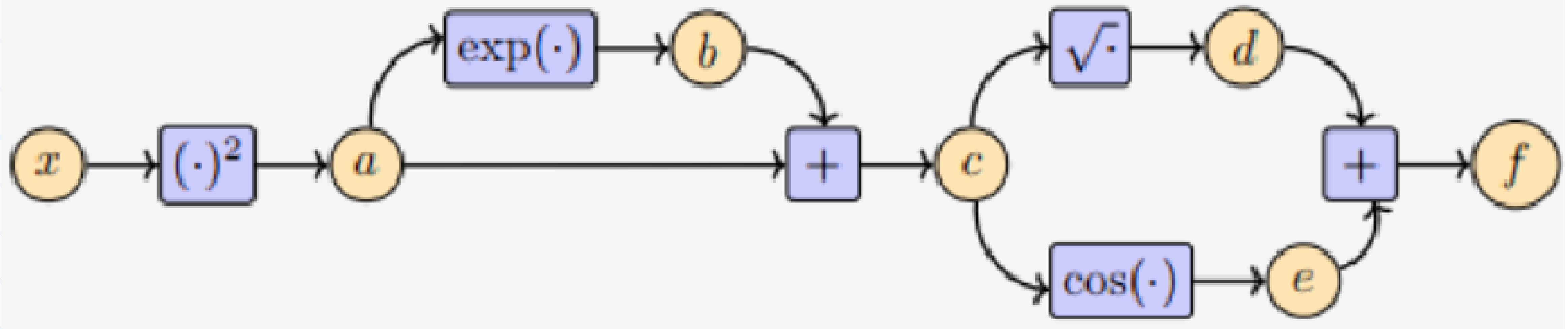
$$\frac{\partial f}{\partial v} = \frac{\partial f}{\partial g}\frac{\partial g}{\partial v} = 20(u v^3)^4 3 u v^2 + \frac{1}{u v^3}\; 3 u v^2$$

$$\nabla_f = \left(20(u v^3) + \frac{1}{u v^3}\right)\left[v^3 \quad 3 u v^2\right]$$

$$= \frac{\partial f}{\partial g} \cdot \left[\frac{\partial g}{\partial u} \quad \frac{\partial g}{\partial v}\right]$$

$$z = f(x_1, \ldots x_n)$$

$$\nabla z$$



$a = x^2$

$b = e^a$

$c = a + b$

$d = \sqrt{c}$ $\quad e = \cos(c)$

$f = d + e$

$$f(x) = \sqrt{x^2 + e^{x^2}} + \cos(x^2 + e^{x^2})$$

$$\frac{\partial f}{\partial x} = \frac{\partial f}{\partial d}\underbrace{\frac{\partial d}{\partial x}}_{\frac{\partial d}{\partial c}\underbrace{\frac{\partial c}{\partial x}}} + \frac{\partial f}{\partial e}\underbrace{\frac{\partial e}{\partial x}}_{\frac{\partial e}{\partial c}\underbrace{\frac{\partial c}{\partial x}}}$$

$$\frac{\partial a}{\partial x} + \underbrace{\frac{\partial b}{\partial x}}_{\frac{\partial b}{\partial a}\frac{\partial a}{\partial x}}$$

$$\frac{\partial f}{\partial d} = 1 = \frac{\partial f}{\partial e}$$

$$\frac{\partial f}{\partial c} = \underbrace{\frac{\partial f}{\partial d}}_{1} \underbrace{\frac{\partial d}{\partial c}}_{1/2\sqrt{c}} + \underbrace{\frac{\partial f}{\partial e}}_{1} \cdot \underbrace{\frac{\partial e}{\partial c}}_{-\operatorname{sen}(c)}$$

$$\frac{\partial f}{\partial b} = \frac{\partial f}{\partial c} \overbrace{\frac{\partial c}{\partial b}}^{=1} = \left(\frac{1}{2\sqrt{c}} - \operatorname{sen}(c) \right) \cdot 1$$

$$\frac{\partial f}{\partial a} = \underbrace{\frac{\partial f}{\partial b}}\ \underbrace{\frac{\partial b}{\partial a}}_{e^{a}} + \underbrace{\frac{\partial f}{\partial c}}\ \underbrace{\frac{\partial c}{\partial a}}_{=1} \checkmark$$

$$\frac{\partial f}{\partial x} = \frac{\partial f}{\partial a} \underbrace{\frac{\partial a}{\partial x}}_{2x}$$

Consultor Kalman

$\hat{x}_{-1}$ (posic. inicial que me imagino)

$y_0 \to$ medición

$x_0 \to$ sabe Dios

↳ pos + ruido

↳ pos.

↳ x_0 + ruido

$\bullet \left(x_k - \hat{x}_{k|k-1}\right)$

$\bullet\ tr(P_{k|k-1})$

$\hat{x}_{0|-1} = A\hat{x}_{-1}$

$\bullet\ x_k - \hat{x}_{k|k}$ innovación

$\bullet\ y_k - C\hat{x}_{k|k-1}$

tengo $\to \hat{x}_{k-1|k-1} \longrightarrow \hat{x}_{k|k-1} = A\hat{x}_{k-1|k-1}$

↳ donde creo que voy a estar en k con con medic hasta $k-1$

$P_{k|k-1} = \mathbb{E}\left[(x_k - \hat{x}_{k|k-1})(x_k - \hat{x}_{k|k-1})^T\right]$

$tr(P) = \mathbb{E}\left[(x_k - \hat{x}_{k|k-1})^T(x_k - \hat{x}_{k|k-1})\right]$

$y_k = x_k +$ ruido

~~Indes~~ del ECM

$\hat{x}_{k|k}$

$$K_k = P_{k|k-1} C_k^T (R_k + C_k P_{k|k-1} C_k^T)^{-1}$$

$$\hat{x}_{k|k} = \underline{\hat{x}_{k|k-1}} + K_k \left(\underbrace{y_m - C\hat{x}_{k|k-1}}_{=\text{innov.}} \right)$$