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CSE 572

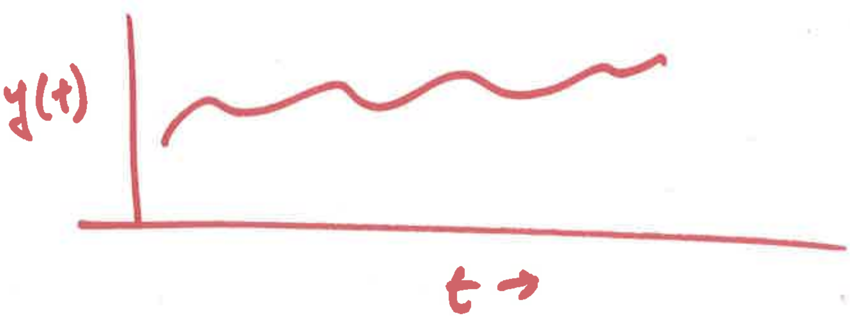
ICA → Independent Component Analysis.

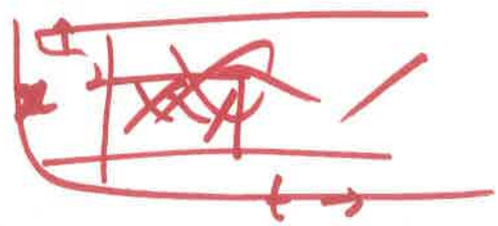
$x \to$ signal $\qquad x = \sum_{\forall i} \omega_i \, s_i(\theta)$

$$\frac{ds_i}{d\theta} \Big/ \frac{ds_j}{d\theta} = 0$$

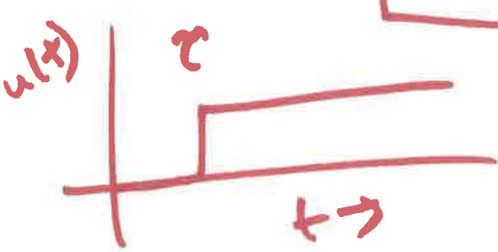
$$\vec{s_i} \cdot \vec{s_j} = 0$$

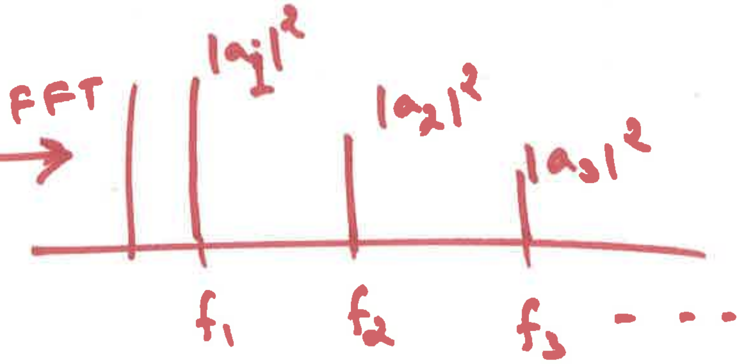
$$x = A s$$



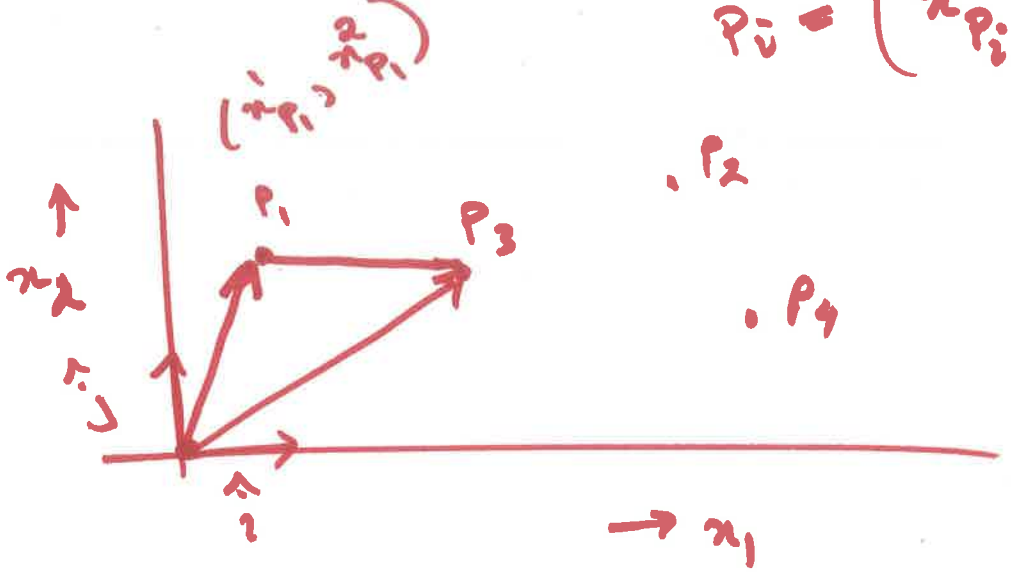


$$y(t) = \sum_{\forall i} a_i \sin(2\pi f_i t + \phi_i)$$





$$P_i = \left(x^1_{P_i}, x^2_{P_i}\right)$$



$$d_e = \sqrt{\left(x^1_{P_1} - x^1_{P_3}\right)^2 + \left(x^2_{P_1} - x^2_{P_3}\right)^2}$$

$$\vec{P}_1 = x^1_{P_1}\,\hat{i} + x^2_{P_1}\,\hat{j}$$

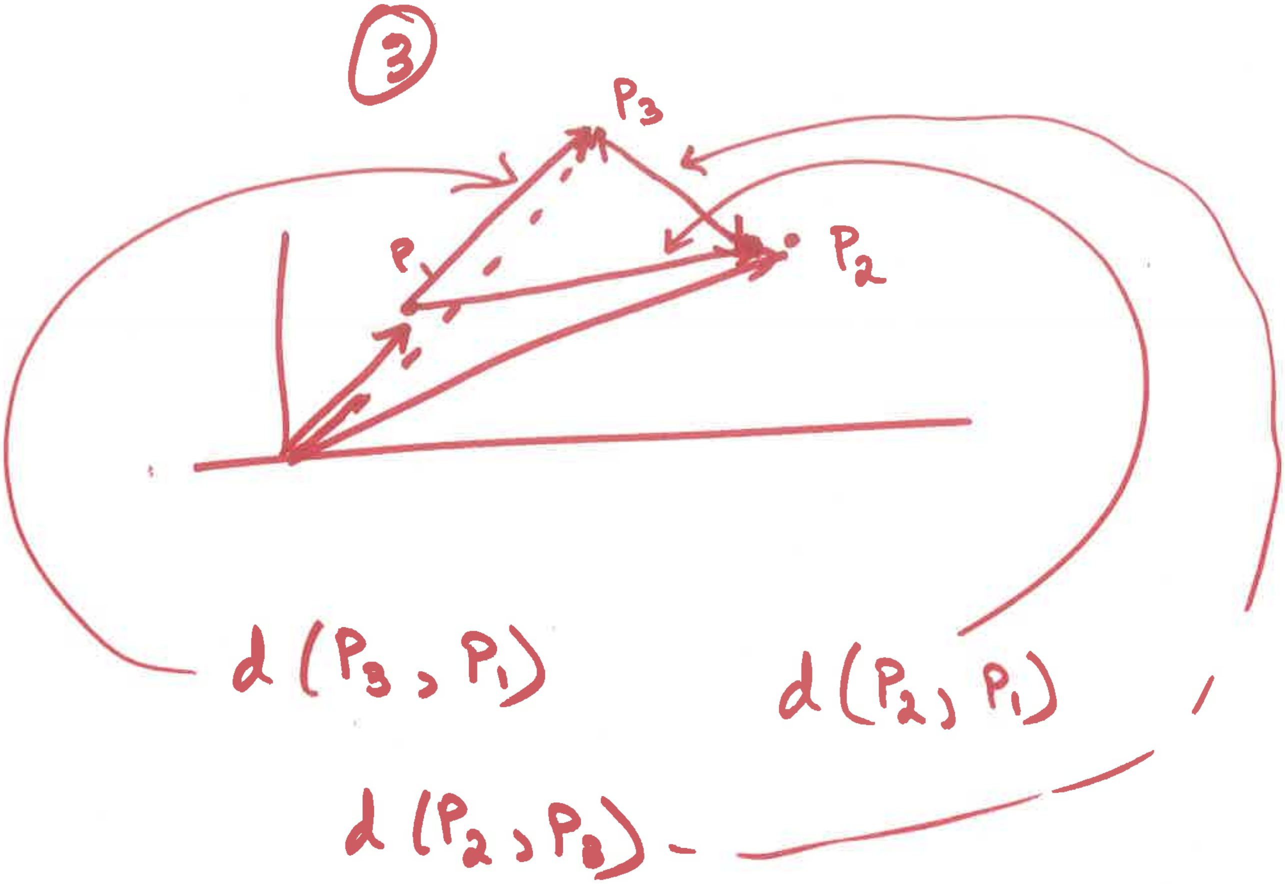
$$\vec{P}_3 = x^1_{P_3}\,\hat{i} + x^2_{P_3}\,\hat{j}$$

$$\vec{P}_3 - \vec{P}_1 = \left(x^1_{P_3} - x^1_{P_1}\right)\hat{i} + \left(x^2_{P_3} - x^2_{P_1}\right)\hat{j}$$

$$d_e = \left|\vec{P}_3 - \vec{P}_1\right|$$

$d_e \geq 0$ (positive definite)

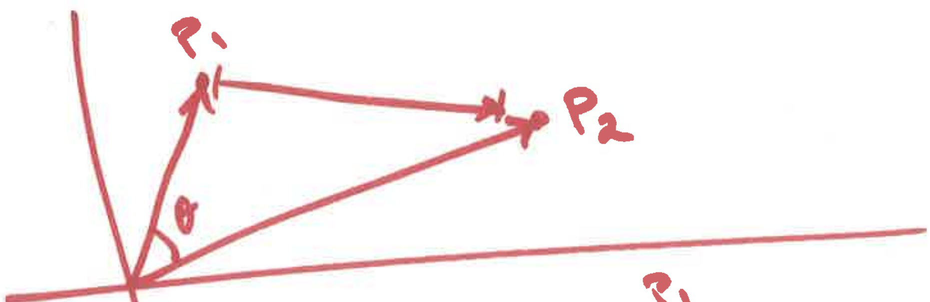
$d(P_1, P_3) = d(P_3, P_1)$
(symmetric)

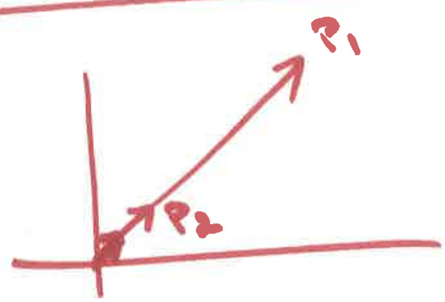


$$d(P_2, P_3) \leq d(P_2, P_1) + d(P_3, P_1)$$

(triangle inequality)

<u>Cosine similarity</u>





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$\vec{d_1}$ $\vec{d_2}$

$$\cos(d_1, d_2) = \frac{\vec{d_1} \odot \vec{d_2}}{\|\vec{d_1}\| \, \|\vec{d_2}\|}$$

$$= \underbrace{\left[\frac{\vec{d_1}}{\|\vec{d_1}\|}\right]}_{\text{unit vector along the direction of } \vec{d_1}} \odot \left[\frac{\vec{d_2}}{\|\vec{d_2}\|}\right]$$

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