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How would we have to enforce not knowing about $\vec{e}_1, \vec{e}_2$ w/ respect to $\vec{b}$?

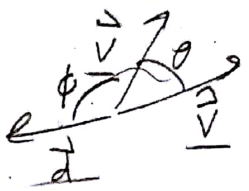
Extra page for scratchwork.
Work on this page will NOT be graded

state   state mag.

$\vec{V}$ $\hat{\vec{V}}$

$$\vec{x} \cdot \vec{d} = |\vec{x}| \cos\phi$$

$(\propto \vec{V})$ (mostly in $\vec{v}$)



$$\vec{V} \cdot \vec{d} = \cos\phi$$

$$\hat{\vec{V}} \cdot \vec{d} = \cos(\phi + \theta)$$

$$\frac{\vec{x} \cdot \vec{d}}{\hat{\vec{V}} \cdot \vec{d}} = |\vec{x}| \boxed{\frac{\cos\phi}{\cos(\phi+\theta)}} = |\hat{\vec{x}}|$$

$$\cancel{\vec{x}_{k+1} = \begin{bmatrix} \lambda_1 & \\ & \lambda_2 \end{bmatrix} \vec{x}_k + \begin{bmatrix} 1 \\ 1 \end{bmatrix} u}$$

$$\lambda_2 x_2[k] + k \frac{\cos\phi}{\cos(\theta+\phi)} |\vec{x}|$$

$$u = k\, |\hat{\vec{x}}| \qquad u = k\, x_1$$

$$x_1[k+1] = (\lambda + k)\, x_1[k]$$

$$x_1[k+1] = \boxed{\left(\lambda_1 + k \frac{\cos\phi}{\cos(\phi+\theta)}\right)} x_1[k]$$

just see what happens (stay concrete)

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Setup 1

$$\vec{X}(t+1) = \begin{bmatrix} \lambda_1 & & & 0 \\ & \lambda_2 & & \\ & & \ddots & \\ 0 & & & \lambda_n \end{bmatrix} \vec{X}(t) + \underbrace{\begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix}}_{\vec{b}} u(t)$$

$\lambda_1, \dots \lambda_n$ unknown.

setup becomes equivalent when we randomize b above w/ P

Setup 2

$$\vec{X}(t+1) = P \begin{bmatrix} \lambda_1 & & & 0 \\ & \ddots & & \\ & & \ddots & \\ 0 & & & \lambda_n \end{bmatrix} P^{-1} x(t) + \begin{bmatrix} 1 \\ 1 \\ \vdots \\ 1 \end{bmatrix} u(t)$$

we're assuming $\Sigma u(t)$ in our code

$A = P \Lambda P^{-1}$

P orthonormal.

P is unknown., $\lambda_1 \dots \lambda_n$ unknown.

But & $\lambda_1 \gg \underbrace{\lambda_2}_{0}$

λ_i not necessarily stable ($|\lambda_i| \neq 1$)

Other assumptions

- knowledge of $\vec{x}[0]$
- noise $w[k]$

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this case better understand

(a) (4 points) Express $\vec{y}[0]$ in terms of $\vec{x}[0]$.

$$\boxed{X(t+1)} = \begin{bmatrix}\lambda_1 & & 0\\ & \ddots & \\ 0 & & \lambda_n\end{bmatrix}\vec{x}(t) + I_{n\times n}\cdot \vec{u}(t)$$

$\lambda_1 >>> \lambda_2 > \lambda_3 \dots$

(1) Don't observe $\vec{x}$

$\vec{x}\cdot\vec{d}$ random.

e_1

~~ordere~~

ordered version.

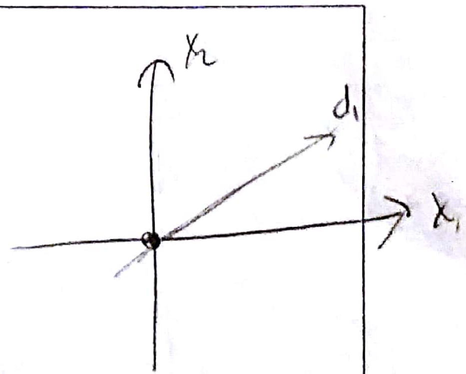
Unordered version. $\exists$ one $\lambda_i >> \lambda_j$ $\forall j \neq i$

But I don't know i.

(b) (6 points) Express $\vec{x}[1]$ and $\vec{y}[1]$ in terms of $\vec{x}[0]$.

How to answer Rahul's Q of "how many observ. needed?"

↳ consult lit.



Rahul's not knowing $\vec{v} \Rightarrow \lambda\vec{v}\vec{v}^T$

→ compressed sensing   OMP? Sparsity, leverage this?

OMP when we're projecting

⇓

Solve easier problem w/ known $\vec{x}$

n is sufficient

cross terms as unknowns

⇓

why not just solve for n^2 entries of A

See if robust PCA sticks ← Lookup: every A under conditions can be decomposed into a low rank and sparse matrices (additively)