

Noisy PAQ responses → trace
measurements

- Assume user responds with an item that is a *noisy distance* $y + \eta$ away from the reference

- Response: noisy scaling γ s.t.

- Equivalent to *trace measurements*

With sensing matrices $A = \gamma^2 a a^T$

Noiseless PAQ

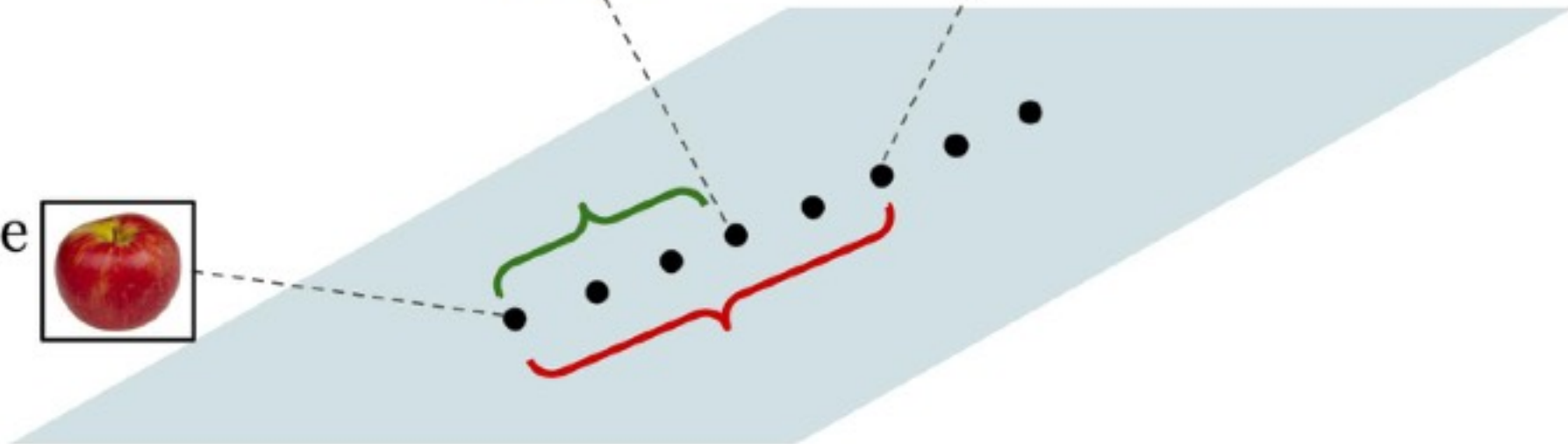
Noisy PAQ

response

response



Reference
item



$$y^2a^{\mathrm{T}}Ma=y+\eta$$



v

+

n

2

0

$$\langle \gamma^2 a a^{\mathrm{T}}, M \rangle \equiv y + \eta$$

Noisy PAQ responses → trace measurements

- Assume user responds with an item that is a noisy *distance* $y + \eta$ away from the reference

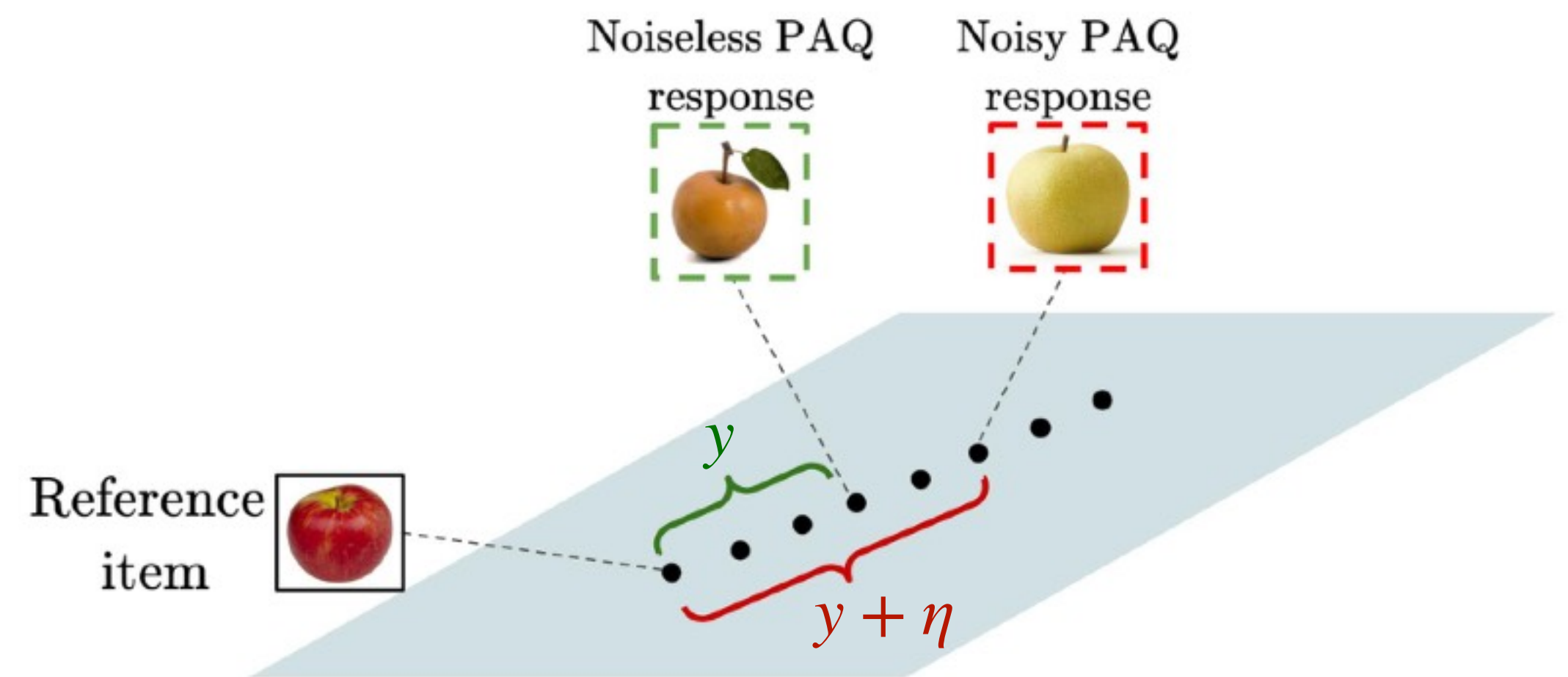
- Response: noisy scaling γ s.t.

$$\gamma^2 \mathbf{a}^\top \mathbf{M} \mathbf{a} = y + \eta$$

- Equivalent to trace measurements

$$\langle \gamma^2 \mathbf{a} \mathbf{a}^\top, \mathbf{M} \rangle = y + \eta$$

With sensing matrices $\mathbf{A} = \gamma^2 \mathbf{a} \mathbf{a}^\top$



Learning from PAQs: challenges

Choose $\mathbf{a}_i \stackrel{iid}{\sim} \mathcal{N}(\mathbf{0}, \mathbf{I}_D)$

Sensing matrices take the form

$$\frac{y + \eta_i}{\mathbf{a}_i^\top \mathbf{M} \mathbf{a}_i} \mathbf{a}_i \mathbf{a}_i^\top$$



Sensing matrix depends on noise! Results in biased estimators