

How is Sketching Useful?

Turnstile Streaming

- **Implicitly initialize a sketching matrix S**

• Initialize $sk(x) \leftarrow 0$

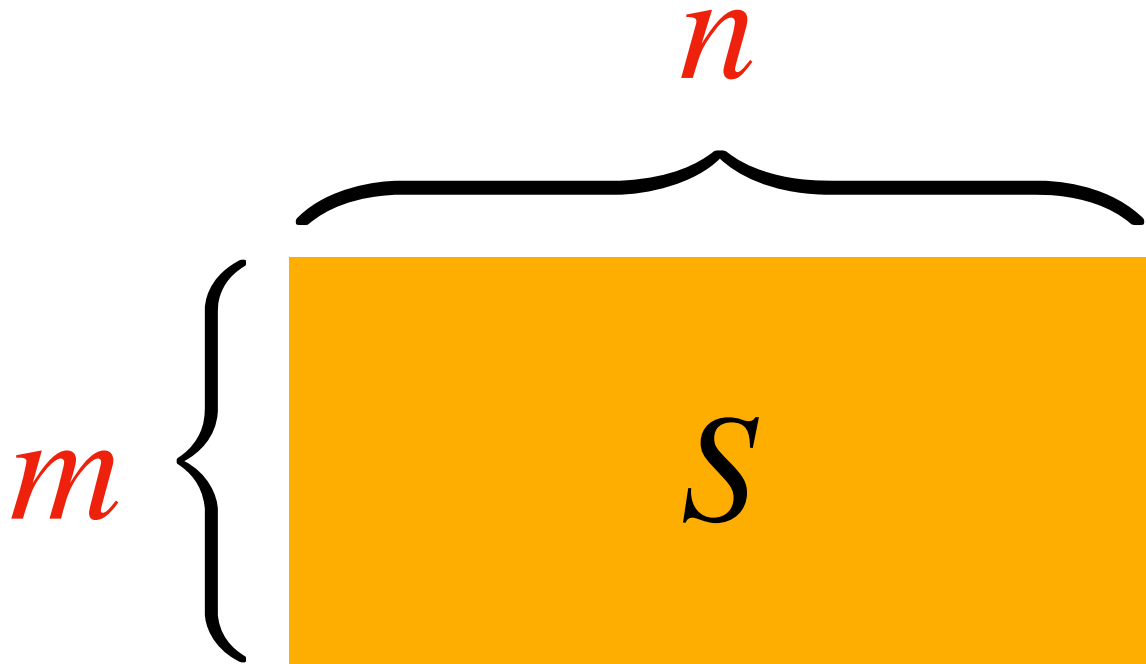
- When $x[i] \leftarrow x[i] + \Delta$:

- Retrieve the i -th column $S *_i$

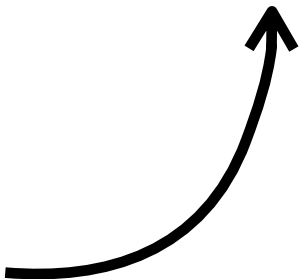
- Update $sk(x) \leftarrow sk(x) + (S_{*i}) \cdot \Delta$

- At all times: $sk(x) \equiv S \cdot x$

- Extract "information" about x from $sk(x)$ at the end



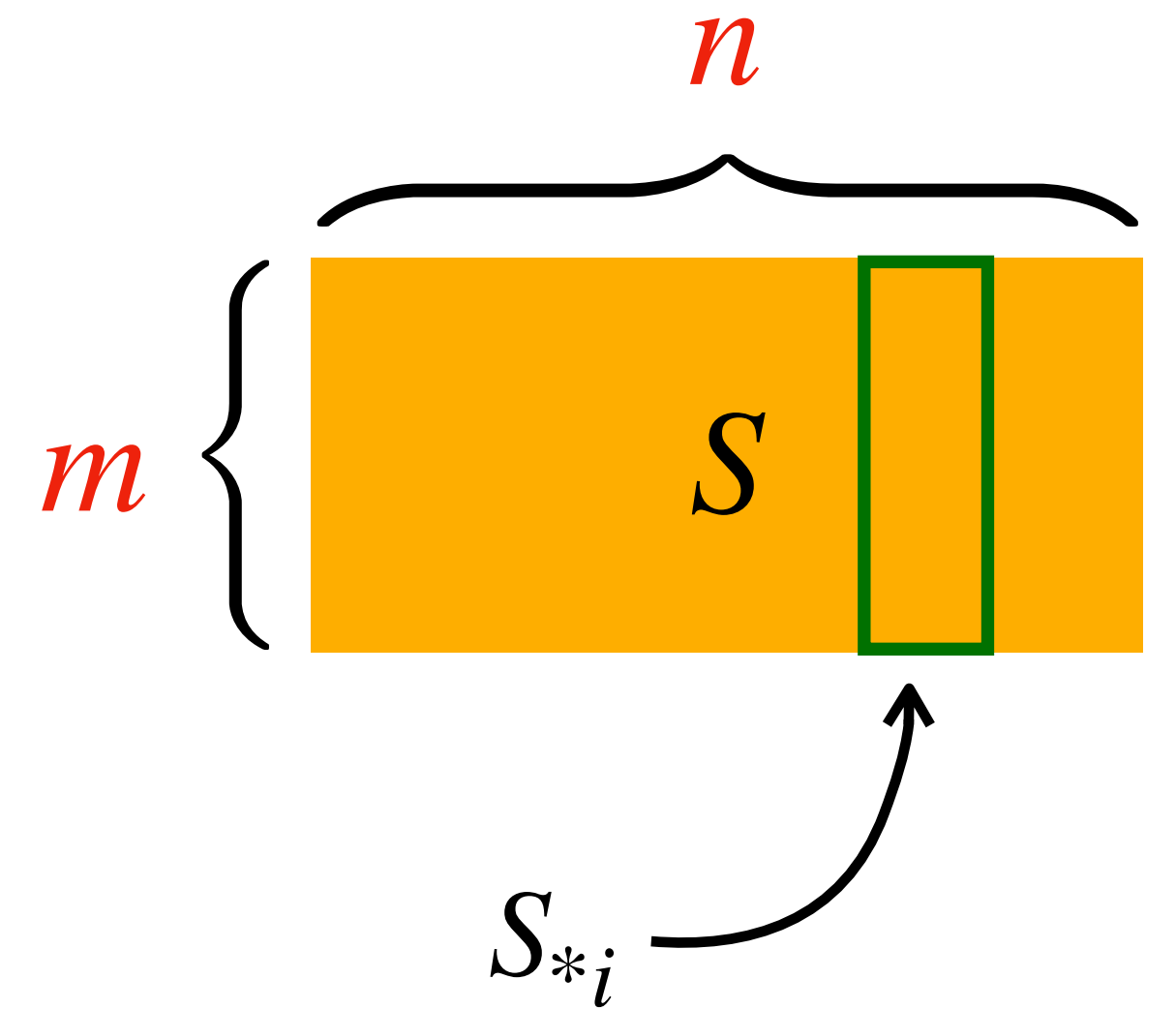
S_{*i}



How is Sketching Useful?

Turnstile Streaming

- **Implicitly** initialize a sketching matrix S
- Initialize $\text{sk}(x) \leftarrow 0$
- When $x[i] \leftarrow x[i] + \Delta$:
 - Retrieve the i -th column S_{*i}
 - Update $\text{sk}(x) \leftarrow \text{sk}(x) + (S_{*i}) \cdot \Delta$
- At all times: $\text{sk}(x) = S \cdot x$
- Extract "information" about x from $\text{sk}(x)$ at the end



How is Sketching Useful?

Turnstile Streaming

- S can be stored using small space \Rightarrow Small space streaming algorithms!
- S_{*i} can be retrieved quickly \Rightarrow Fast **update** times