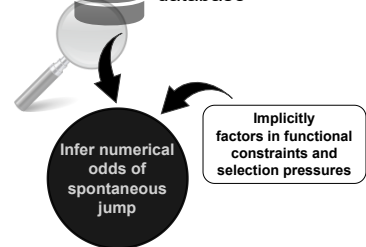


H1N1 2018  
Haemagglutinin Sequences

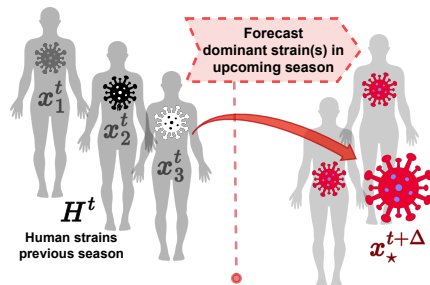
GGAAAACAAAAGCAACAAAA...TGA~~A~~AAAAGA...  
 AGCAAAAGCAGGGGAAAAACA...GTT~~C~~AACCAC...  
 AGCAAAAGCAGGGGAAAAACA...GTT~~T~~AACCAC...  
 ATGAAGACTATCATTTGCTTT...ACC~~T~~TGAGAA...

residue  
at index 1274

/// A/Italy/7366/2018  
 /// A/Baltimore/P0264/2018  
 /// A/Baltimore/P0278/2018  
 /// A/Florida/61/2018

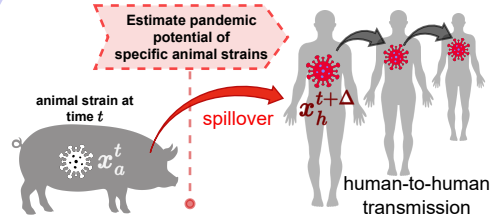


### Application 1



$$x_*^{t+\Delta} = \underset{x}{\operatorname{argmax}} \prod_{x^t \in H^t} \Pr(x^t \rightarrow x)$$

### Application 2



$$\text{risk}(x_a^t) = \log \Pr(x_a^t \rightarrow x_h^{t+\Delta})$$