HMM Inference: The Viterbi Algorithm HMMs: model of $P(y,x) = P(y_i) P(x_i|y_i) P(y_z|y_i) ...$ Inference: argmax $P(\overline{y}|\overline{x}) = \frac{argmax}{y} \frac{P(\overline{y},\overline{x})}{P(\overline{x})} constant$ $= \underset{\overline{y}}{\operatorname{argmax}} P(\overline{y}, \overline{x}) = \underset{\overline{y}}{\operatorname{argmax}} \log P(\overline{y}, \overline{x})$ $= \underset{\widetilde{Y}_{1}, \ldots, \widetilde{Y}_{n}}{\operatorname{argmax}} \log P(\widetilde{y}_{1}) + \log P(X_{1}|\widetilde{y}_{1}) + \log P(\widetilde{y}_{2}|\widetilde{y}_{1}) + \cdots$

Viterbi Dynamic Program

u sent len Define $V_i(\tilde{y}) = n \times |T|$ ITI number of tags score of the best path ending in grat time i

Base: $V_1(\overline{y}) = \log P(x_1|\overline{y}) + \log P(\overline{y})$

Recurrence: $V_i(\tilde{y}) = \log P(x_i|\tilde{y}) + \max_{\text{yprev}} \log P(\tilde{y}|\tilde{y}_{\text{prev}}) + V_{i-1}(\tilde{y}_{\text{prev}})$

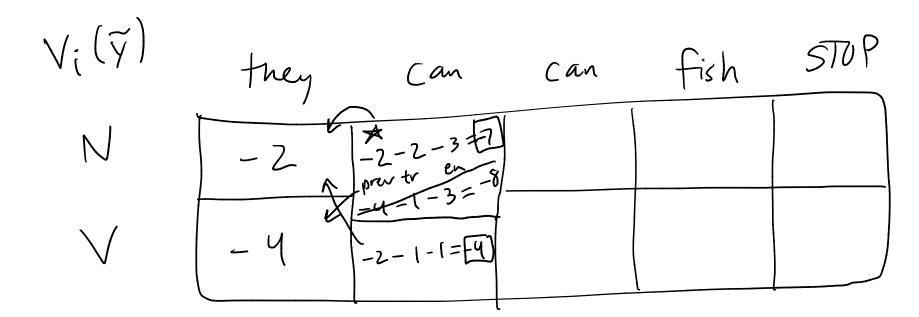
Viterbi for i=1...n

> for Fin T: compute $Vi(\widetilde{x})$

 $\frac{max}{y} \log P(\overline{x}, \overline{y})$ Compute Vn+1 (STOP), this = Track "backpointers"

Example log probs

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STOP