

$$\begin{aligned}
\hat{l} &= \operatorname{argmax}_l p(s, l) \\
&= \operatorname{argmax}_l p(s | l) p(l) \\
&= \operatorname{argmax}_l p(s | l) \\
&= \operatorname{argmax}_l \prod_{i=1}^n p(w_i | l) \\
&= \operatorname{argmax}_l \log \prod_{i=1}^n p(w_i | l) \\
&= \operatorname{argmax}_l \sum_{i=1}^n \log p(w_i | l)
\end{aligned}$$