$$\hat{l} = \underset{l}{\operatorname{argmax}} \ p(s, l)$$

$$= \underset{l}{\operatorname{argmax}} \ p(s \mid l) \, p(l)$$

$$= \underset{l}{\operatorname{argmax}} \ p(s \mid l)$$

$$= \underset{l}{\operatorname{argmax}} \prod_{i=1}^{n} p(w_i \mid l)$$

$$= \underset{l}{\operatorname{argmax}} \log \prod_{i=1}^{n} p(w_i \mid l)$$

$$= \underset{l}{\operatorname{argmax}} \sum_{i=1}^{n} \log p(w_i \mid l)$$