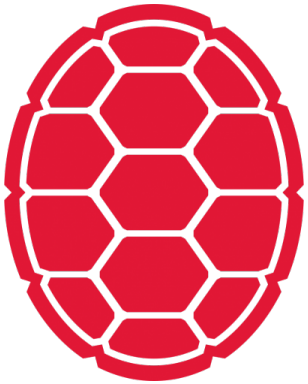


# Machine Translation

Computational Linguistics: Jordan Boyd-Graber
University of Maryland

WORD-BASED MODELS

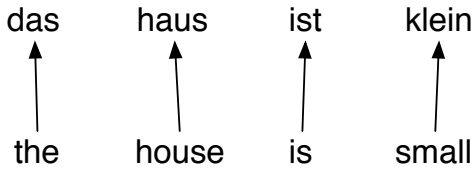
Adapted from material by Philipp Koehn

## Example

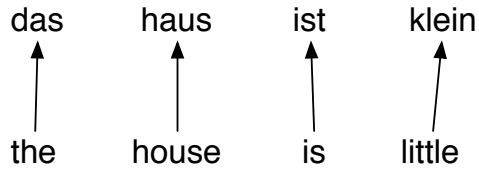
| das | | Haus | | ist | | klein | |
|---|---|---|---|---|---|---|---|
| e | t(e\| f) | e | t(e\| f) | e | t(e\| f) | e | t(e\| f) |
| the | 0.7 | house | 0.8 | is | 0.8 | small | 0.4 |
| that | 0.15 | building | 0.16 | 's | 0.16 | little | 0.4 |
| which | 0.075 | home | 0.02 | exists | 0.02 | short | 0.1 |
| who | 0.05 | household | 0.015 | has | 0.015 | minor | 0.06 |
| this | 0.025 | shell | 0.005 | are | 0.005 | petty | 0.04 |

$$p(\mathbf{e}, a|\mathbf{f}) = \frac{\epsilon}{(l_f+1)^{l_e}} \prod_{j=1}^{l_e} t(e_j|f_{a(j)})$$

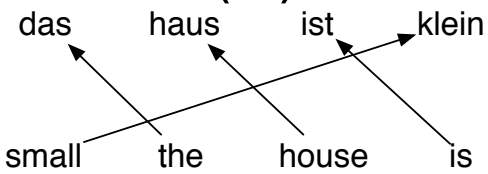
(A)



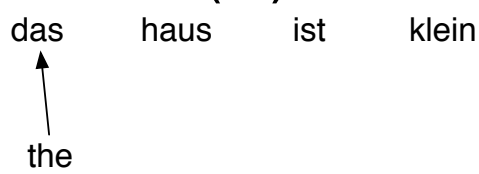

(B)




(C)




(D)



# Example

## Example

A)

$$\frac{1.0}{(4+1)^4}.7 \cdot .8 \cdot .8 \cdot .4 = \tag{1}$$

## Example

A)

$$\frac{1.0}{(4+1)^4}.7 \cdot .8 \cdot .8 \cdot .4 = 0.00029 \quad (1)$$

## Example

B)

## Example

B)

$$\frac{1.0}{(4+1)^4}.7 \cdot .8 \cdot .8 \cdot .4 = \tag{1}$$

## Example

B)

$$\frac{1.0}{(4+1)^4}.7 \cdot .8 \cdot .8 \cdot .4 = 0.00029 \tag{1}$$

## Example

C)

## Example

C)

$$\frac{1.0}{(4+1)^4}.7 \cdot .8 \cdot .8 \cdot .4 = \tag{1}$$

## Example

C)

$$\frac{1.0}{(4+1)^4}.7 \cdot .8 \cdot .8 \cdot .4 = 0.00029 \tag{1}$$

## Example

D)

## Example

D)

$$\frac{1.0}{(4+1)}.7 \cdot .8 \cdot .8 \cdot .4 = \tag{1}$$

## Example

D)

$$\frac{1.0}{(4+1)}.7 \cdot .8 \cdot .8 \cdot .4 = 0.14 \quad (1)$$