COMPACT REPRESENTATIONS OF WORD LOCATION INDEPENDENCE IN CONNECTIONIST MODELS

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Research questions

1. What kinds of representations emerge in Cascade- Correlation neural networks when learning word location independence task?
2. Can we find evidence for open bigram representations?

Open bigrams

Coding that involves pairs of letters that allow for non-contiguous letters, but is order-preserving, ex: WITH --> WI, WT, WH, IT, IH and TH

Methods

Task: Location independent encoder task

Example: WITH in 3 locations

Input	Output
WITH##	WITH
#WITH#	WITH
##WITH	WITH

Corpus: 1179 words of four letters

Neural network coding: each letter slot is encoded using 26 binary values indicating the presence and absence of a given letter (Blanks: [0 0 0... 0])

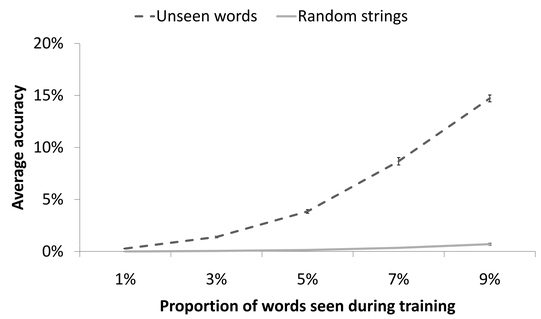
Example:

A : [1 0 0 ... 0],

Z : [0 0 … 1].

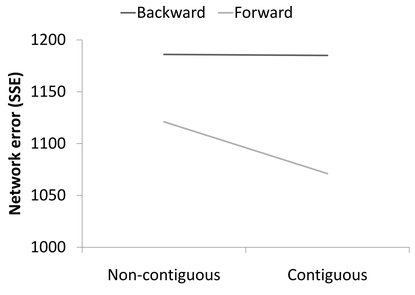
Results

a. Generalization to unseen words



b. Evidence for open bigrams

Train on ABCD, EFGH

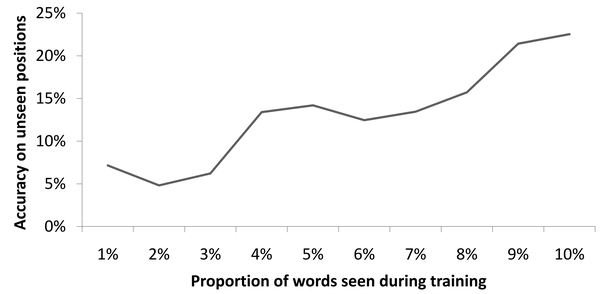


Test bigrams	Forward	Backward
Letter contiguous	ABEF; EFAB; ABFG; FGAB; ABGH; GHAB; BCEF; EFBC; BCFG; FGBC; BCGH; GHBC; CDEF; EFCD; CDFG; FGCD; CDGH; GHCD;	BAFE; FEBA; BAGF; GFBA; BAHG; HGBA; CBFE; FECB; CBGF; GFCB; CBHG; HGCB; DCFE; FEDC; DCGF; GFDC; DCHG; HGDC;
Letter non-Contiguous	ACEG; EGAC; ACEH; EHAC; ACFH; FHAC; ADEG; EGAD; ADEH; EHAD; ADFH; FHAD; BDEG; EGBD; BDEH; EHBD; BDFH; FHBD;	CAGE; GECA; CAHE; HECA; CAHF; HFCA; DAGE; GEDA; DAHE; HEDA; DAHF; HFDA; DBGE; GEDB; DBHE; HEDB; DBHF; HFDB;

Actual (real) bigrams are forward so we expected less error on forward than backward bigrams

c. Generalization to unseen positions

Example: train: ##WITH, WITH## test: #WITH#



Discussion

1. Cascor learned word structure regularities and location invariance simultaneously
2. Error patterns compatible with open bigram representations

References

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