AI Camp

FUNDAMENTALS OF NLP

NLP101

PRESENTED BY

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WORKSHOP PLAN

- INTRODUCTION
- TEXT PREPROCESSING
- WORD EMBEDDINGS
  - WORD2VEC,
  - GLOVE
  - FASTTEXT CONCEPTS
- APPLICATION :
  - NLTK
  - SPACY

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INTRODUCTION

ELIZA	CHATGPT
1966	2022
REGEX	TRANSFORMERS

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INTRODUCTION

HOW REGEX CAN SIMULATE A CHATBOT ?

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TEXT PREPROCESSING

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TEXT PREPROCESSING

ELIZA

PATTERN MATCHING + SUBSTITUTION = CONVERSATION.

```
User:   I am unhappy.
ELIZA:  DO YOU THINK COMING HERE WILL HELP YOU NOT TO BE UNHAPPY
User:   I need some help, that much seems certain.
ELIZA:  WHAT WOULD IT MEAN TO YOU IF YOU GOT SOME HELP
User:   Perhaps I could learn to get along with my mother.
ELIZA:  TELL ME MORE ABOUT YOUR FAMILY
User:   My mother takes care of me.
ELIZA:  WHO ELSE IN YOU FAMILY TAKES CARE OF YOU
User:   My father.
ELIZA:  YOUR FATHER
User:   You are like my father in some ways.
```

Weizenbaum (1966)

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TEXT PREPROCESSING

ELIZA

PATTERN MATCHING + SUBSTITUTION = CONVERSATION.

```
s/.* YOU ARE (depressed|sad) .*/I AM SORRY TO HEAR YOU ARE \1/
s/.* YOU ARE (depressed|sad) .*/WHY DO YOU THINK YOU ARE \1/
s/.* all .*/IN WHAT WAY/
s/.* always .*/CAN YOU THINK OF A SPECIFIC EXAMPLE/
```

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TEXT PREPROCESSING

SIMPLE WORD PROCESSING TECHNIQUE COULD CREATE A DECENT RESULT

BUT

WHAT COUNTS AS A WORD?

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TEXT PREPROCESSING

SPEECH RECOGNITION

WE CONSIDER PUNCTUATION AS A WORD

TEXT FOCUSED TASKS

DEPENDS ON THE TASK

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TEXT PREPROCESSING

CORPORA

TEXT

SPEECH

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TEXT PREPROCESSING

CORPORA

WORD TYPES: 3 **WORD INSTANCES:** 4

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TEXT PREPROCESSING

LEMMAS VS. WORDFORMS

LEMMA: THE BASE FORM OF A WORD

CAT FOR CATS

WORDFORMS: FULL INFLECTED OR DERIVED FORMS

CATS FROM CAT

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TEXT PREPROCESSING

WORD TOKENIZATION

- PREPARES TEXT FOR ANALYSIS
- EASIER TO PROCESS TEXT
- FOUNDATION FOR TEXT REPRESENTATION (E.G WORD EMBEDDINGS)

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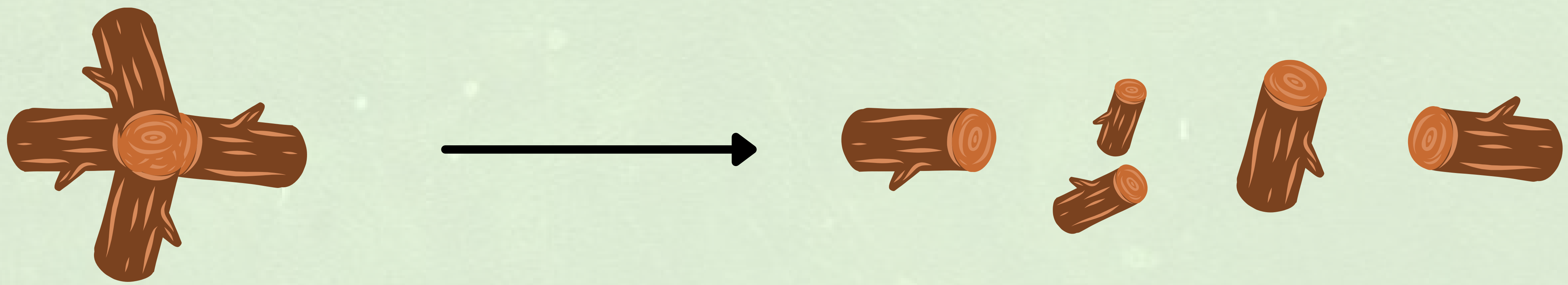
TEXT PREPROCESSING

WORD TOKENIZATION

1-TOP-DOWN (RULE-BASED) TOKENIZATION

DEFINING RULES (MAINLY REGEX) THAT WILL SPLIT CORPORA INTO TOKENS



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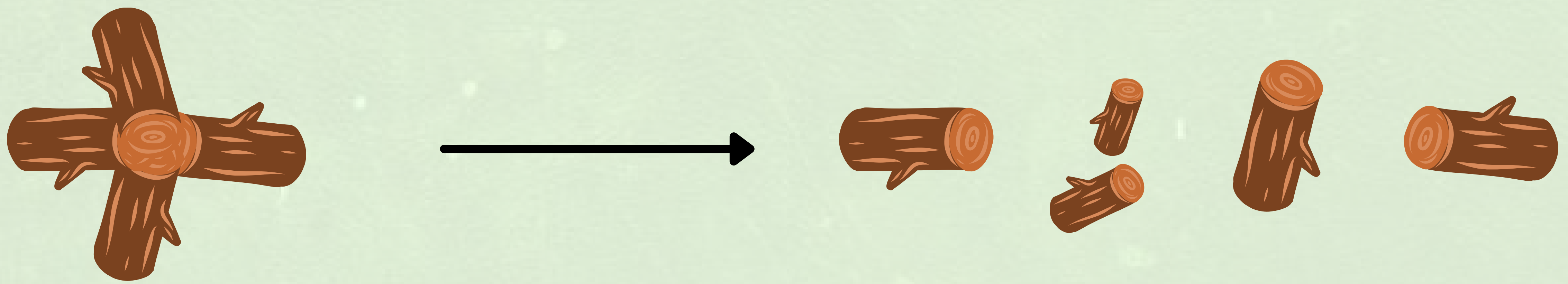
TEXT PREPROCESSING

WORD TOKENIZATION

1-TOP-DOWN (RULE-BASED) TOKENIZATION

```
Input: "The San Francisco-based restaurant," they said, "doesn't charge $10".

Output: ['The', 'San', 'Francisco-based', 'restaurant', ',', '"', 'does', "n't",
'charge', '$', '10', '.']
```



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TEXT PREPROCESSING

WORD TOKENIZATION

2-BOTTOM-UP TOKENIZATION

```
5 l o w
2 l o w e s t
6 n e w e r
3 w i d e r
2 n e w
```

→

```
l, o, w, e, r, s, t, er, ne, low, newer.
```

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TEXT PREPROCESSING

WORD NORMALIZATION

RAW CORPORA → NORMALIZED CORPORA IN STANDARD FORMAT

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TEXT PREPROCESSING

WORD NORMALIZATION

CASE FOLDING

CONVERTS ALL CHARACTERS TO LOWERCASE.

EFFECTIVE FOR INFORMATION RETRIEVAL AND SPEECH RECOGNITION

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TEXT PREPROCESSING

WORD NORMALIZATION

CHOOSE A SINGLE STANDARD FORM FOR VARIATIONS

EXAMPLE: USA AND US, UH-HUH AND UHHUH.

USEFUL IN TASKS LIKE INFORMATION RETRIEVAL, WHERE WE WANT TO RETRIEVE DOCUMENTS MENTIONING EITHER FORM.

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TEXT PREPROCESSING

WORD NORMALIZATION

LEMMATIZATION

IDENTIFIES THE ROOT FORM (LEMMA) OF A WORD

`am`, `are`, and `is` → `be`.

`dinner` and `dinners` → `dinner`.

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TEXT PREPROCESSING

WORD NORMALIZATION

LEMMATIZATION

HELPS IN WEB SEARCH OR INFORMATION RETRIEVAL BY TREATING VARIATIONS OF A WORD AS EQUIVALENT:

Example: A query for `woodchucks` should also return results for `woodchuck`.

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TEXT PREPROCESSING

WORD NORMALIZATION

LEMMATIZATION

COMPLICATED TO DETECTS LEMMA BECAUSE IT USES SOPHISTICATED METHODS USING

MORPHEMES **AFFIXES**

Example: Spanish word `amaren` (`if in the future they would love`) →

- `amar` (to love) + morphological features (third person plural, future subjunctive).

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TEXT PREPROCESSING

WORD NORMALIZATION

STEMMING

- NAIVE WAY COMPARED TO LEMMATIZATION
- CHOPPING OFF WORD ENDINGS (AFFIXES) WITHOUT UNDERSTANDING THE MORPHOLOGICAL STRUCTURE.

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TEXT PREPROCESSING

WORD NORMALIZATION

STEMMING

Original text:

> This was not the map we found in Billy Bones's chest, but an accurate copy, complete in all things-names and heights and soundings-with the single exception of the red crosses and the written notes.

→

Stemmed text:

> Thi wa not the map we found in Billi Bone s chest but an accur copi complet in all thing name and height and sound with the singl except of the red cross and the written note.

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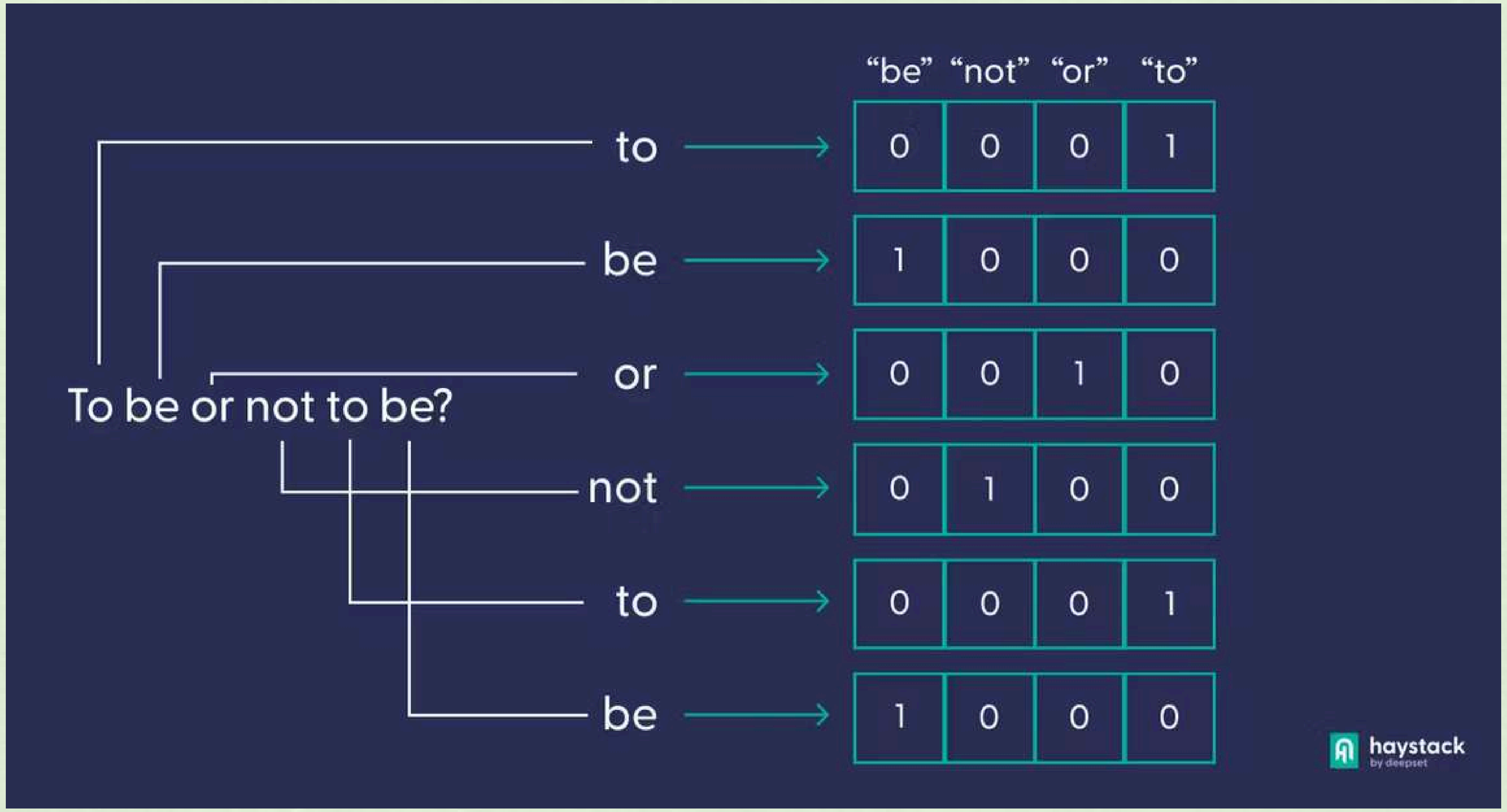
WORD EMBEDDINGS

TEXT EMBEDDINGS ARE NUMERICAL REPRESENTATIONS OF WORDS,



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WORD EMBEDDINGS

WHY ?

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WORD EMBEDDINGS

CONTEXTUAL UNDERSTANDING

GENERALIZATION

ENHANCED MACHINE LEARNING TASKS

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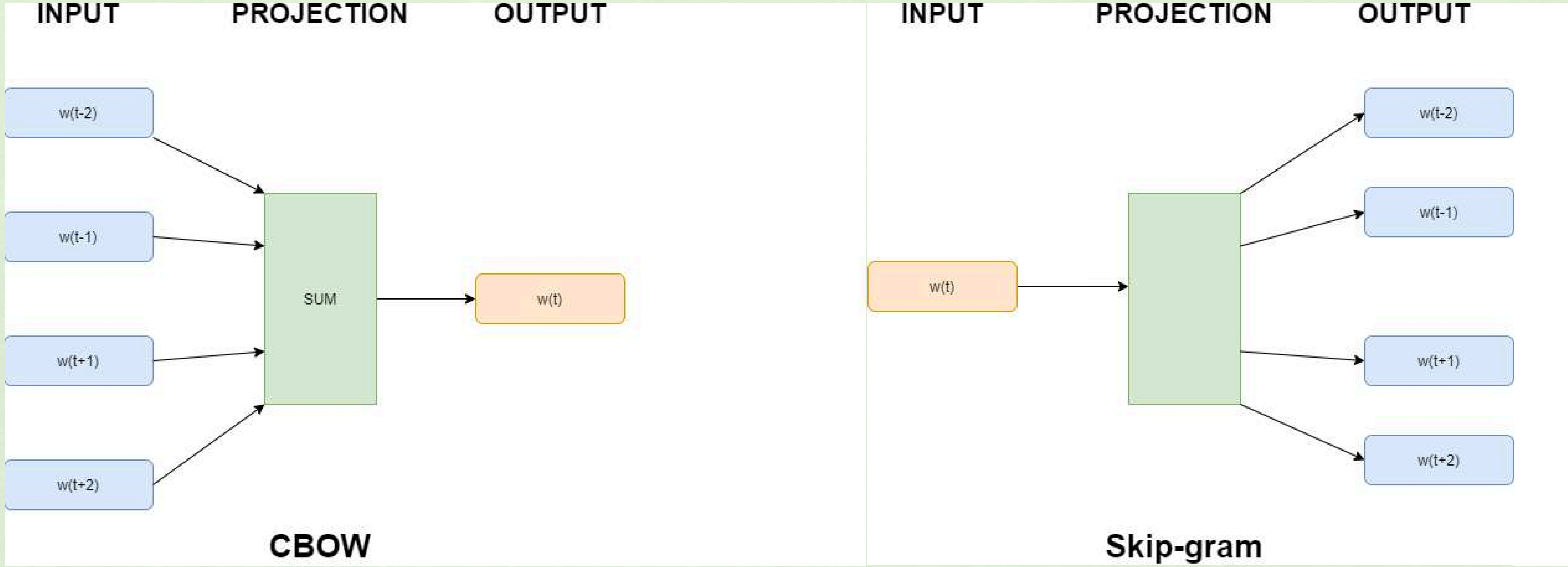
WORD EMBEDDINGS

WORD2VEC

LOCAL CONTEXT ONLY



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WORD EMBEDDINGS

GLOVE

LOCAL CONTEXT + WORD CO-OCCURRENCE

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WORD EMBEDDINGS

FASTTEXT

- CHARACTER N-GRAMS (E.G., "PLAYING" → "PLAY", "ING", "LAY").
- THESE SUBWORDS ARE TRAINED TO GENERATE EMBEDDINGS

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WORD EMBEDDINGS

WORD2VEC

GLOVE

FASTTEXT

Feature	Word2Vec	GloVe	FastText
Developer	Google	Stanford	Facebook AI
Core Idea	Context-based	Co-occurrence	Subword-based
Context	Local	Local + Global	Local
Handles OOV?	No	No	Yes
Efficiency	High	Moderate	Moderate
Polysemy	No	No	Partially
Applications	General NLP	Large Corpora	Morphologically rich languages, OOV handling

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APPLICATION TIME

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