Next Token Prediction

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NEXT TOKEN GENERATION

- Inspired by great lecture(s)

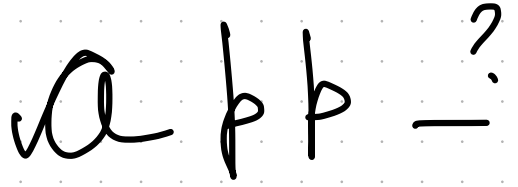
  from Andrej Karpathy.

  ↳ search for

  Neural Networks

  Zero to Hero

- We discussed relevance to chat GPT



What is the next character?

apple ?

What is the next character?

Pose as classification task

apple

c	P(c)
a	0.01
b	...
⋮	
l	0.4
⋮	
z	
_	

Specific Problem

- Generate Indian names
- Dataset : aabid
  aabida
  aadesh
  ⋮
  ⋮
  zeel

Specific Problem

- Generate Indian names
- Dataset : aabid
  aabida
  aadesh
  ⋮
  zeel

Assume

1) Only 26 lower case char
2) _ indicates end char
3) $4 < len < 10$

Generate Training Dataset

WORD #1

aabid

say we consider	'history / content' of 3 chars.

X	y
_ _ _	a
_ _ a	a
_ a a	b
a a b	i
a b i	d
b i d	_

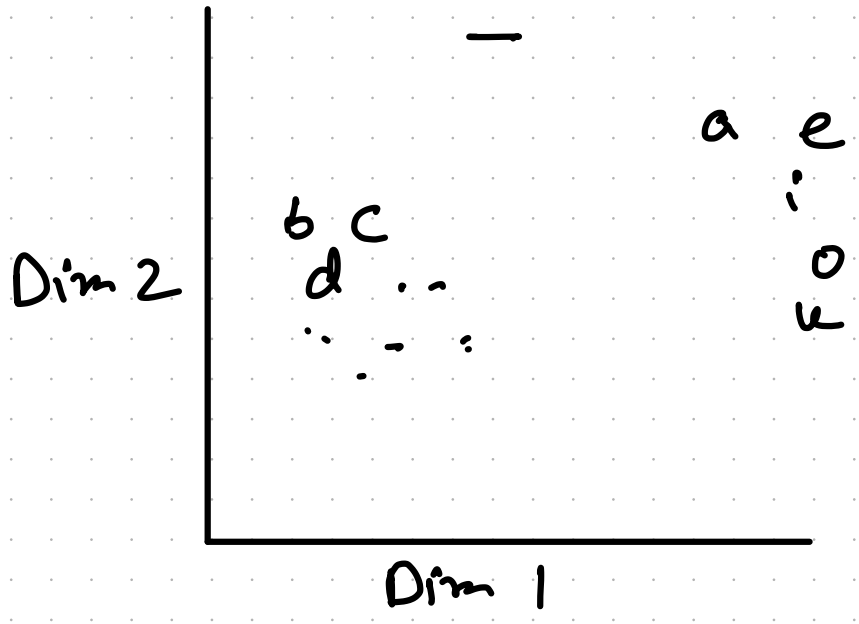
7 training examples from 1 name

Important Idea

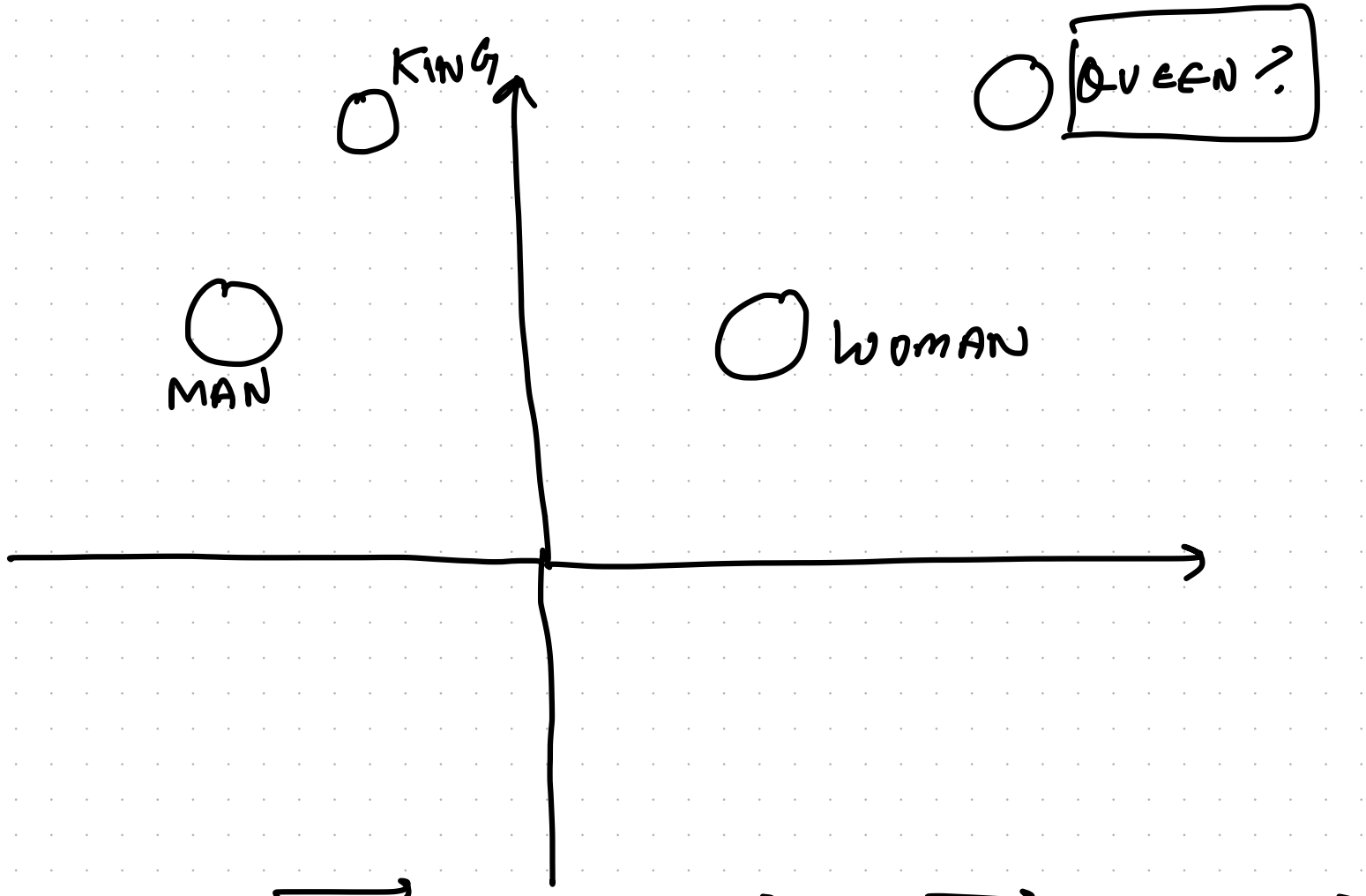
Representation

→ Learn a vector representation for each character

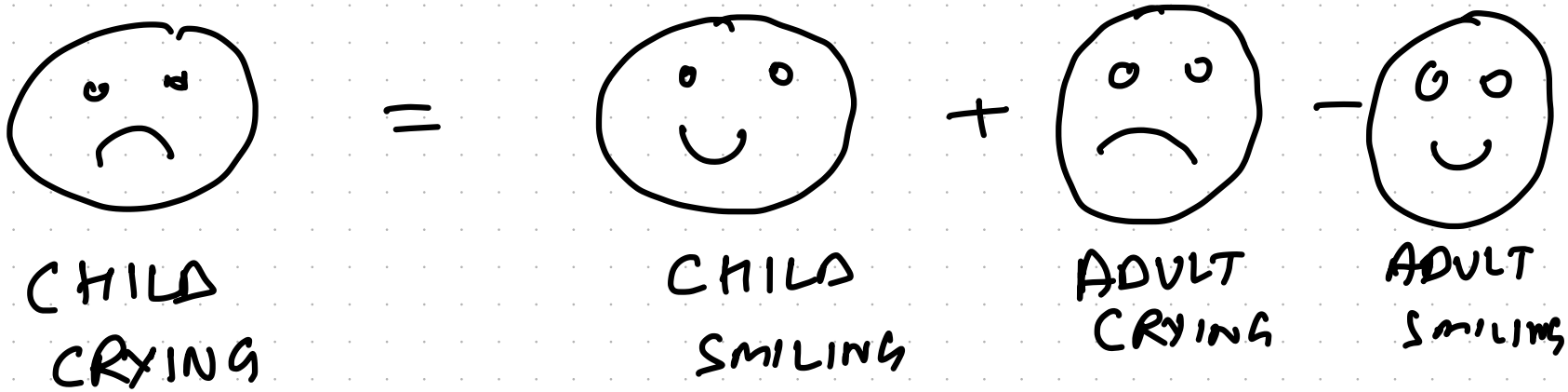
→ 'Similar' characters → closer in vector space



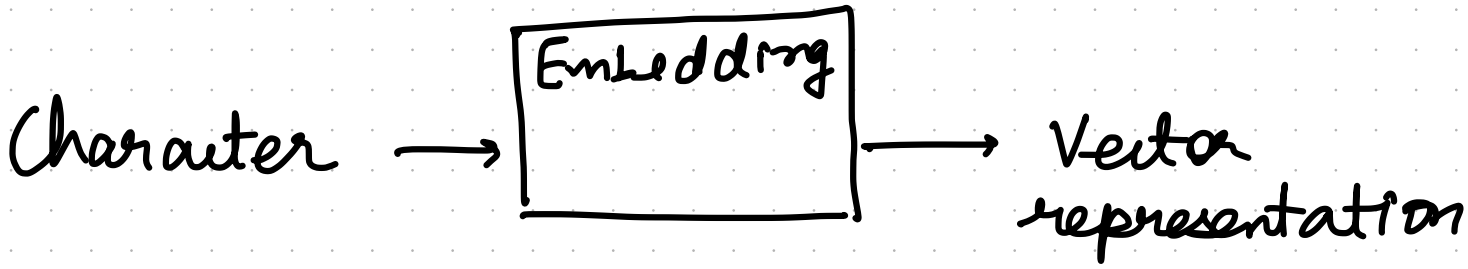
WORD2VEC



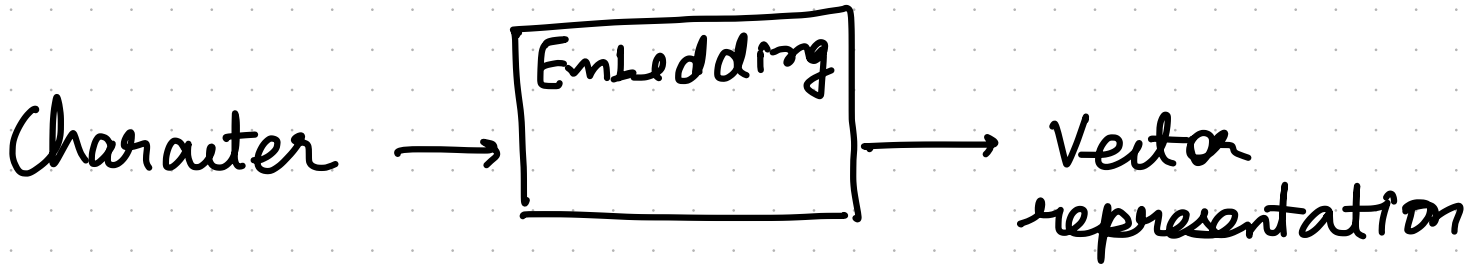
$$\overrightarrow{QUEEN} = \overrightarrow{KING} - \overrightarrow{MAN} + \overrightarrow{WOMAN}$$


CHILD CRYING
=
CHILD SMILING
+
ADULT CRYING
-
ADULT SMILING

Embedding matrix | table



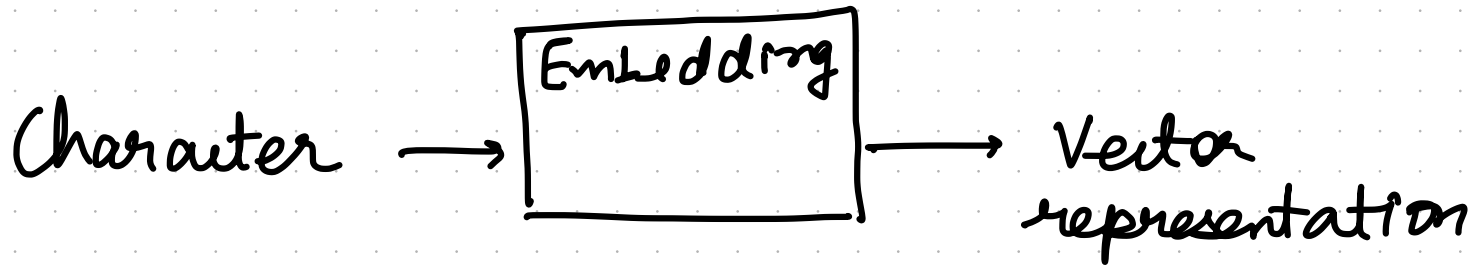
Embedding matrix | table



- Given 27 char (a, .. z, -), 'k' dim embedding

	Dim 1	Dim 2 ..	Dim K
a	0.1	.. .	..
b			
:			
.			
i			
z			
-			

Embedding matrix | table



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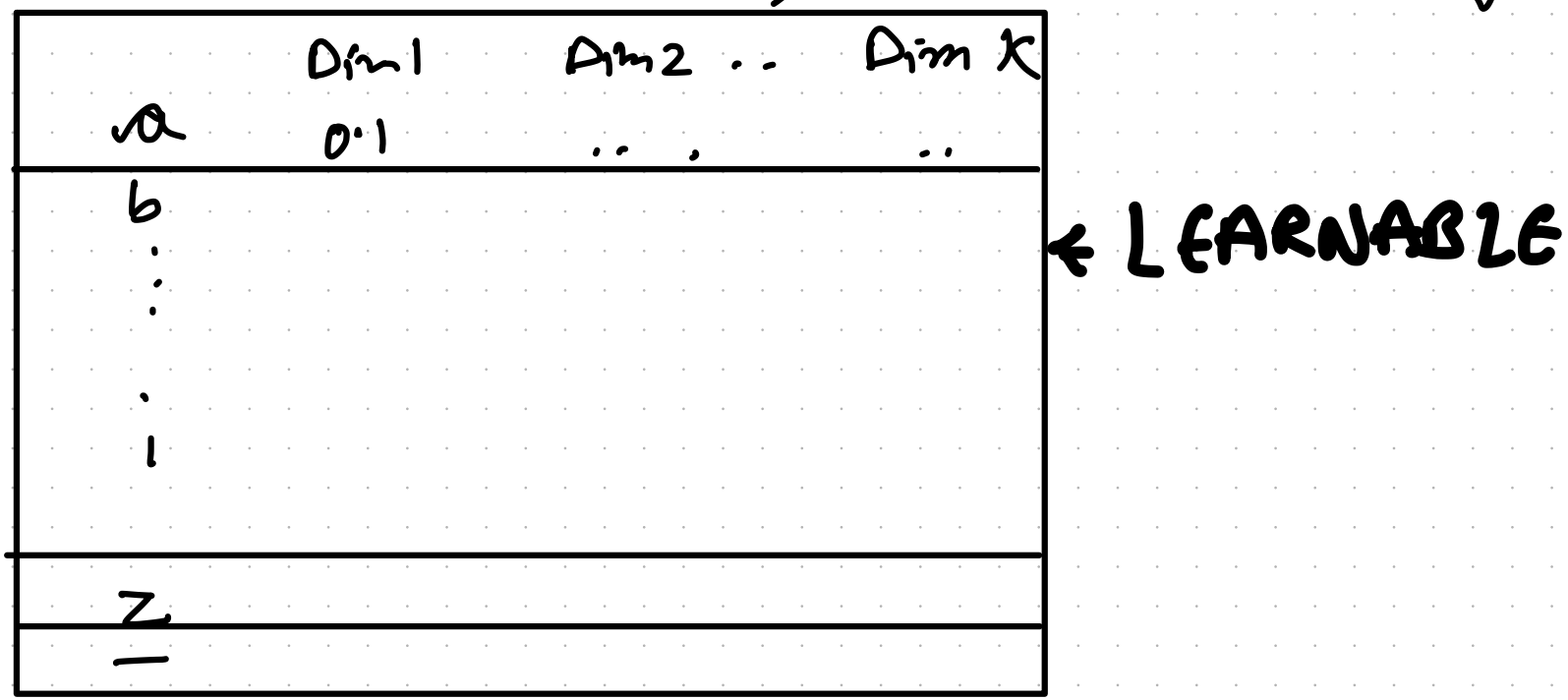
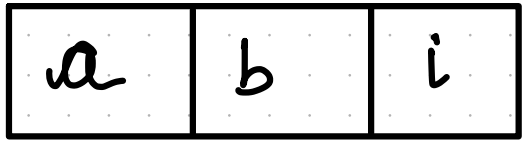


OVERALL ARCHITECTURE

- For illustrat², 2dim embedding

X



OVERALL ARCHITECTURE

1) LOOKUP EMBEDDING

X

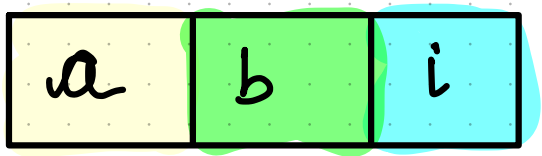
a	b	i

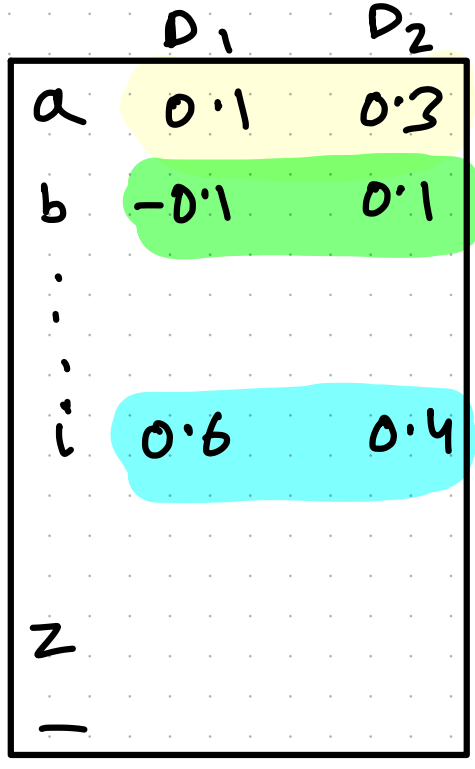
	D_1	D_2
a	0·1	0·3
b	-0·1	0·1
⋮		
i	0·6	0·4
z		
—		

OVERALL ARCHITECTURE

1) LOOKUP EMBEDDING

X

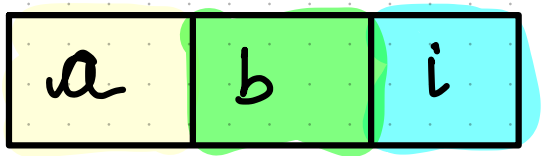


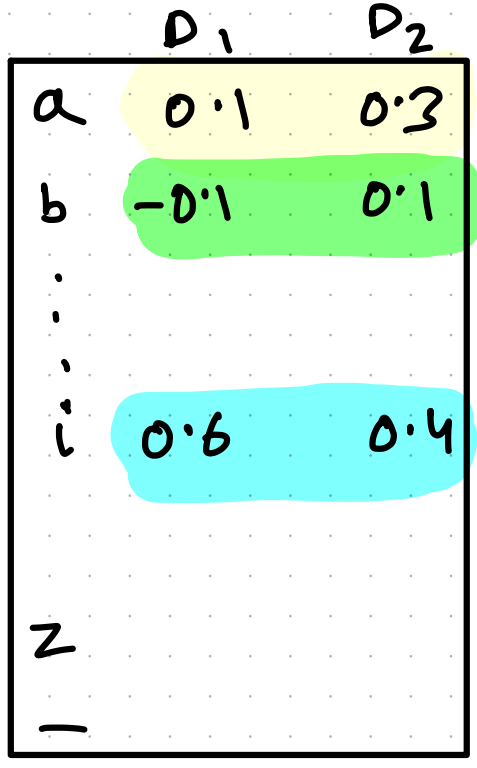


OVERALL ARCHITECTURE

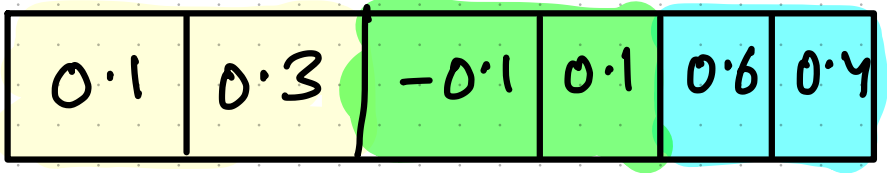
2) CONCATENATE EMBEDDINGS

X



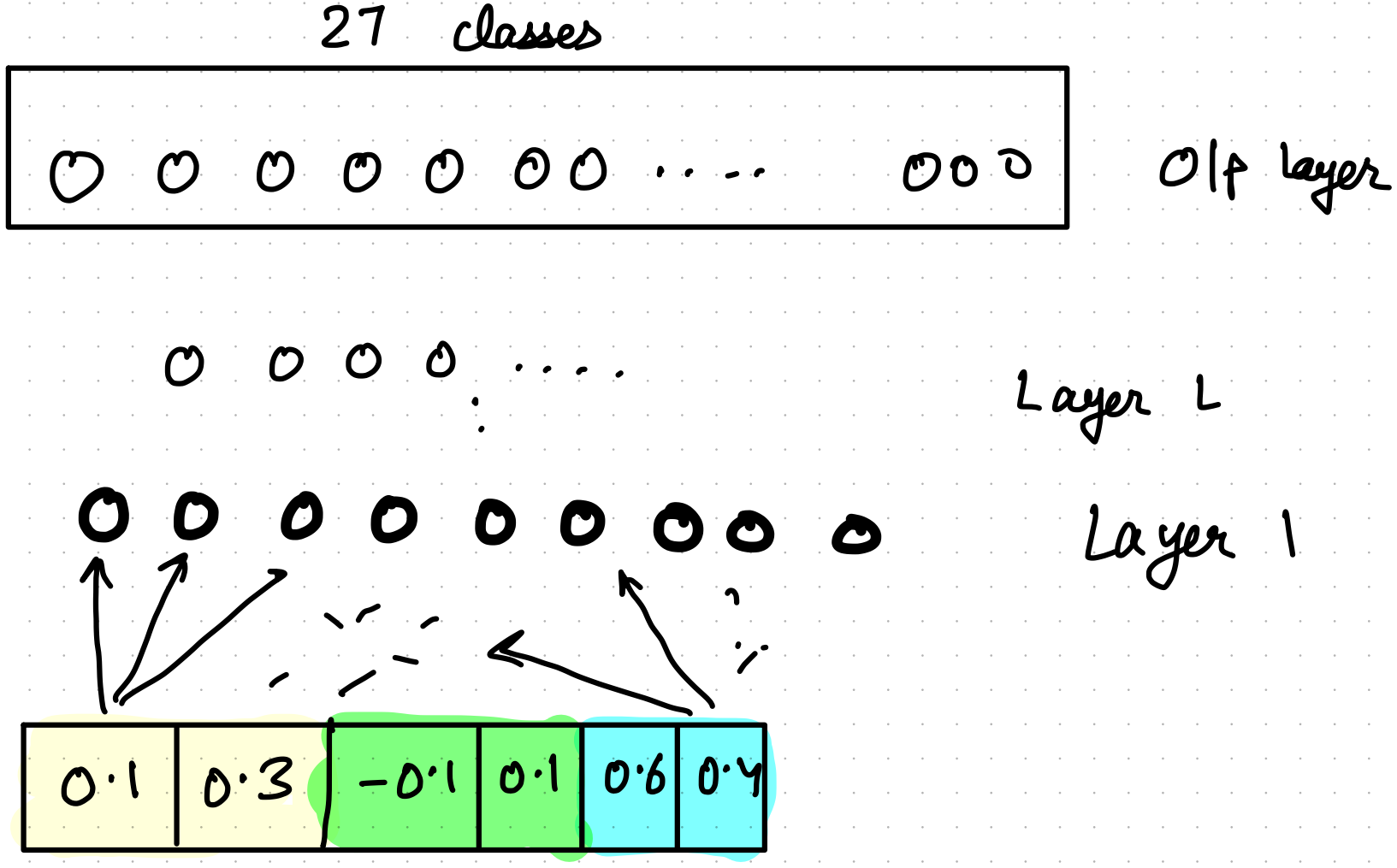


Feature Vector



OVERALL ARCHITECTURE

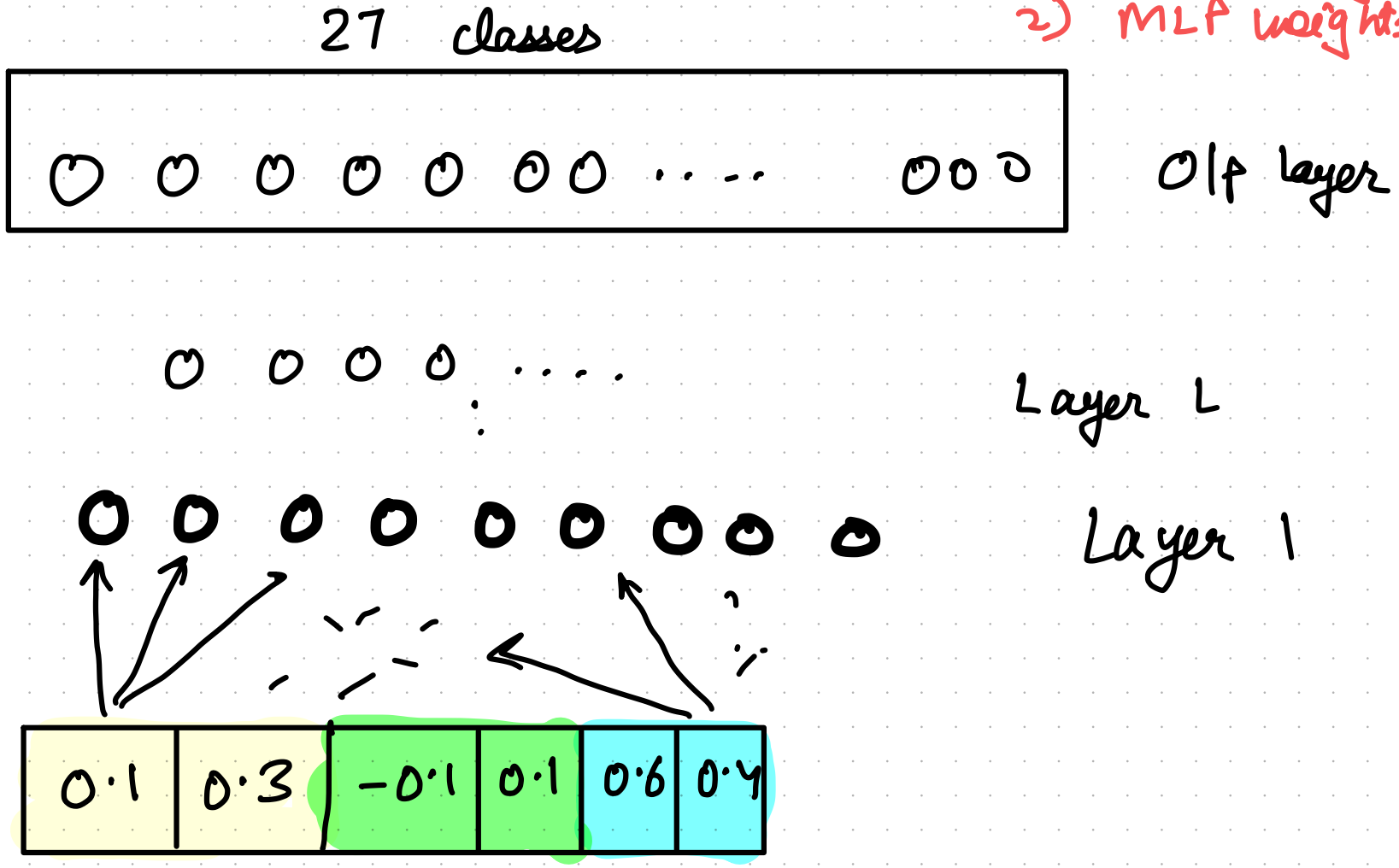
3) MLP



OVERALL ARCHITECTURE

4) USE CROSS ENTROPY LOSS TO LEARN

1) Embeddings
2) MLP weights



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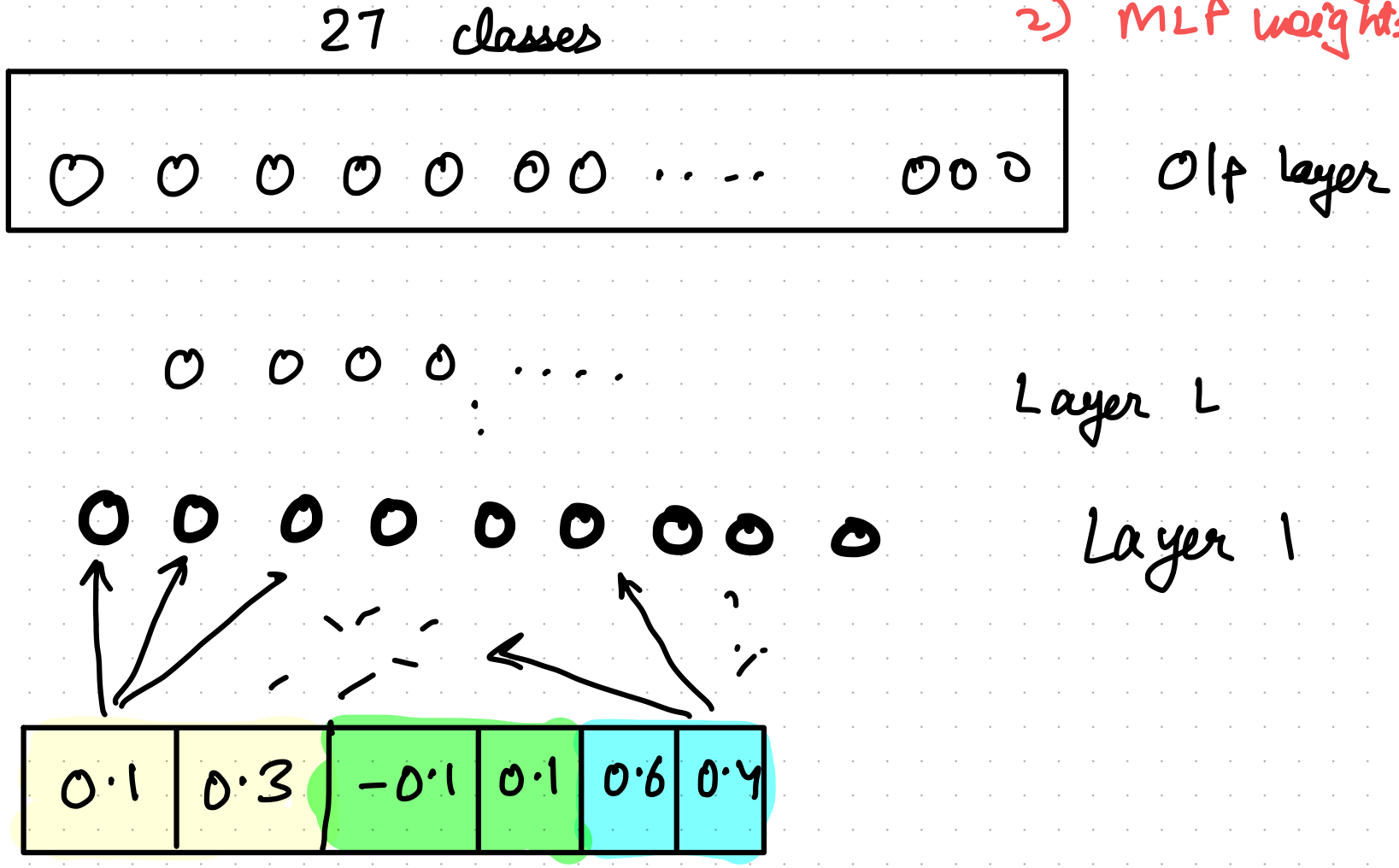

OVERALL ARCHITECTURE

5) GENERATION | SAMPLING

Test i/p

a b i

Test o/p

c	P(c)
a	0.01
b	0.01
c	0.01
d	0.6
e	:
:	:
:	:
:	:
:	:
z	:
_	

OVERALL ARCHITECTURE

5) GENERATION | SAMPLING

Test i/p

a b i

Sample from Prob. distribution

ab i a 1%.

ab i b 1%.

ab i d 60%.

⋮

Test o/p

c	P(c)
a	0.01
b	0.01
c	0.01
d	0.6
e	⋮
⋮	⋮
z	⋮

OVERALL ARCHITECTURE

5) GENERATION | SAMPLING