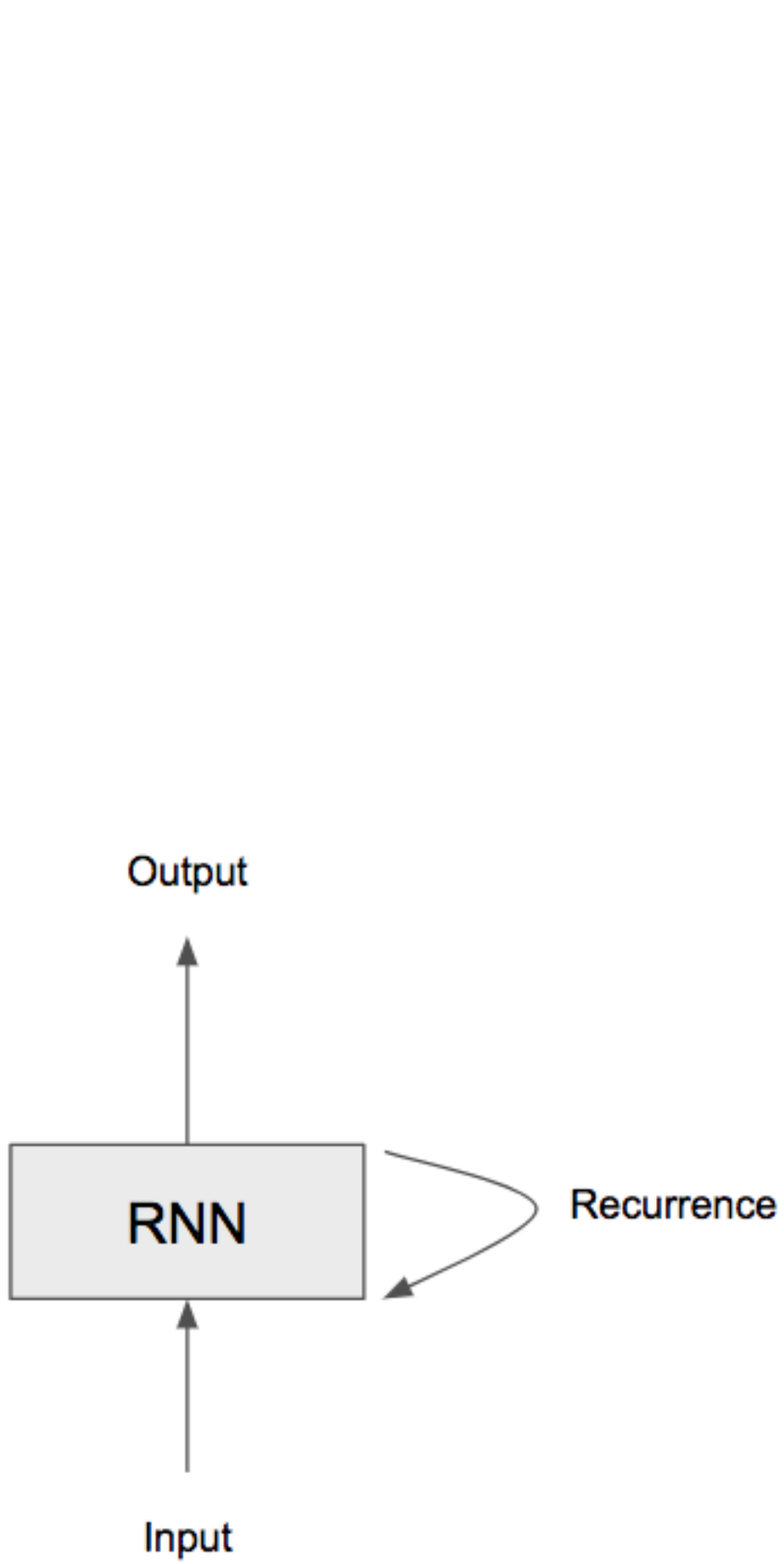
repeated , recurring , repetitive

Recurrent Neural Network

https://www.youtube.com/watch?time_continue=5&v=LHXXI4-IEns



Limitation of ANN

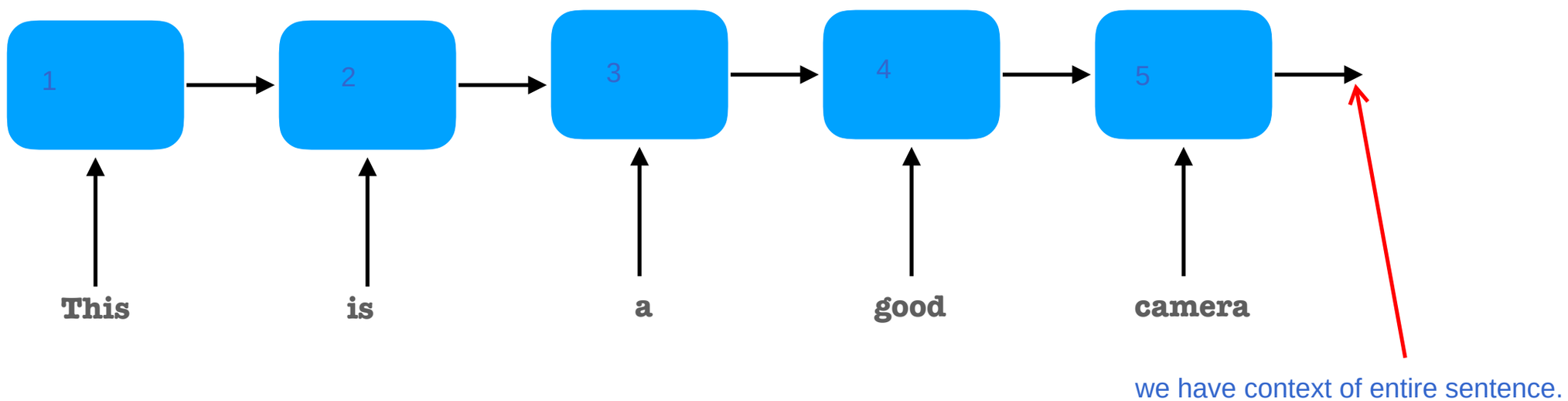
	camera	good	best	bad	material	Target
Sample 1: good camera	1.	1.	0.	0.	0.	1
Sample 2: best camera	1.	0.	1.	0.	0.	1
Sample 3: bad material	0.	0.	0.	1.	1.	0

ANN doesn't look at the context of sentence what you pass but it will just see the words individually.

If the sentence looses its context then there will be high chance that it might loose the meaning also.

Looking back

Example: This is a good camera



Topics

1. Representing samples with context using CV
2. Padding in samples
3. Feed-forward in RNN
4. Variations in RNN
5. Where we use RNN?

1 Representing samples with context using CV

Representing samples using count vestorizer with context preserved

https://towardsdatascience.com/natural-language-processing-count-vectorization-with-scikit-learn-e7804269bb5e

Architecture of RNN

Let' say you are doing sentence classification.

Training data

X_train	Y_train
Camera is very good	1
Battery is very bad	0
Screen is awesome	1
Display is not good	0

1 = positive
0 = negative

all unique vocabes in training data base

CV representation of training data

Samples \ Vocabulary	Camera	is	very	good	Battery	bad	Screen	awesome	Display	not
Camera is very good	1	1	1	1	0	0	0	0	0	0
Battery is very bad	0	1	1	0	1	1	0	0	0	0
Screen is awesome	0	1	0	0	0	0	1	1	0	0
Display is not good	0	1	0	1	0	0	0	0	1	1

Samples \ Vocabulary	Camera	is	very	good	Battery	bad	Screen	awesome	Display	not
Camera is very good	1	1	1	1	0	0	0	0	0	0
Battery is very bad	0	1	1	0	1	1	0	0	0	0
Screen is awesome	0	1	0	0	0	0	1	1	0	0
Display is not good	0	1	0	1	0	0	0	0	1	1

Sample 3 CV represent.

Samples \ Vocabulary	Camera	is	very	good	Battery	bad	Screen	awesome	Display	not
Screen is awesome	0	1	0	0	0	0	1	1	0	0

Camera	is	very	good	Battery	bad	Screen	awesome	Display	not
0	0	0	0	0	0	1	0	0	0
0	1	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	0	0

Screen is awesome

```
[ [0, 0, 0, 0, 0, 0, 1, 0, 0, 0],
  [0, 1, 0, 0, 0, 0, 0, 0, 0, 0],
  [0, 0, 0, 0, 0, 0, 1, 0, 0, 0] ]
```

Samples \ Vocabulary	Camera	is	very	good	Battery	bad	Screen	awesome	Display	not
Camera is very good	1	1	1	1	0	0	0	0	0	0
Battery is very bad	0	1	1	0	1	1	0	0	0	0
Screen is awesome	0	1	0	0	0	0	0	1	0	0
Display is not good	0	1	0	1	0	0	0	0	1	1

Camera is very good

```
[ [1, 0, 0, 0, 0, 0, 0, 0, 0, 0],
  [0, 1, 0, 0, 0, 0, 0, 0, 0, 0],
  [0, 0, 1, 0, 0, 0, 0, 0, 0, 0],
  [0, 0, 0, 1, 0, 0, 0, 0, 0, 0] ]
```

Battery is very bad

```
[ [0, 0, 0, 0, 1, 0, 0, 0, 0, 0],
  [0, 1, 0, 0, 0, 0, 0, 0, 0, 0],
  [0, 0, 1, 0, 0, 0, 0, 0, 0, 0],
  [0, 0, 0, 0, 0, 1, 0, 0, 0, 0] ]
```

Screen is awesome

```
[ [0, 0, 0, 0, 0, 0, 1, 0, 0, 0],
  [0, 1, 0, 0, 0, 0, 0, 0, 0, 0],
  [0, 0, 0, 0, 0, 0, 1, 0, 0, 0] ]
```

Display is not good

```
[ [0, 0, 0, 0, 0, 0, 0, 0, 1, 0],
  [0, 1, 0, 0, 0, 0, 0, 0, 0, 0],
   [0, 0, 0, 0, 0, 0, 0, 0, 0, 1],
  [0, 0, 0, 1, 0, 0, 0, 0, 0, 0] ]
```

2 Padding in samples

Should we have padding on end of sentence?

Samples \ Vocabulary	Camera	is	very	good	Battery	bad	Screen	awesome	Display	not
Camera is very good	1	1	1	1	0	0	0	0	0	0
Battery is very bad	0	1	1	0	1	1	0	0	0	0
Screen is awesome	0	1	0	0	0	0	0	1	0	0
Display is not good	0	1	0	1	0	0	0	0	1	1

Camera is very good

```
[ [1, 0, 0, 0, 0, 0, 0, 0, 0, 0],
  [0, 1, 0, 0, 0, 0, 0, 0, 0, 0],
  [0, 0, 1, 0, 0, 0, 0, 0, 0, 0],
  [0, 0, 0, 1, 0, 0, 0, 0, 0, 0] ]
```

4

Battery is very bad

```
[ [0, 0, 0, 0, 1, 0, 0, 0, 0, 0],
  [0, 1, 0, 0, 0, 0, 0, 0, 0, 0],
  [0, 0, 1, 0, 0, 0, 0, 0, 0, 0],
  [0, 0, 0, 0, 0, 1, 0, 0, 0, 0] ]
```

4

Screen is awesome

```
[ [0, 0, 0, 0, 0, 0, 1, 0, 0, 0],
  [0, 1, 0, 0, 0, 0, 0, 0, 0, 0],
  [0, 0, 0, 0, 0, 0, 1, 0, 0, 0] ]
```

```
[ [0, 0, 0, 0, 0, 0, 1, 0, 0, 0],
  [0, 1, 0, 0, 0, 0, 0, 0, 0, 0],
  [0, 0, 0, 0, 0, 0, 1, 0, 0, 0],
  [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]]
```

4

Display is not good

```
[ [0, 0, 0, 0, 0, 0, 0, 0, 1, 0],
  [0, 1, 0, 0, 0, 0, 0, 0, 0, 0],
  [0, 0, 0, 0, 0, 0, 0, 0, 0, 1],
  [0, 0, 0, 1, 0, 0, 0, 0, 0, 0] ]
```

4

What is the maximum length of sentence in our corpus?

CV without context representation

CV representation without context

Samples \ Vocabulary	Camera	is	very	good	Battery	bad	Screen	awesome	Display	not
Camera is very good	1	1	1	1	0	0	0	0	0	0
Battery is very bad	0	1	1	0	1	1	0	0	0	0
Screen is awesome	0	1	0	0	0	0	0	1	0	0
Display is not good	0	1	0	1	0	0	0	0	1	1

CV with context representation

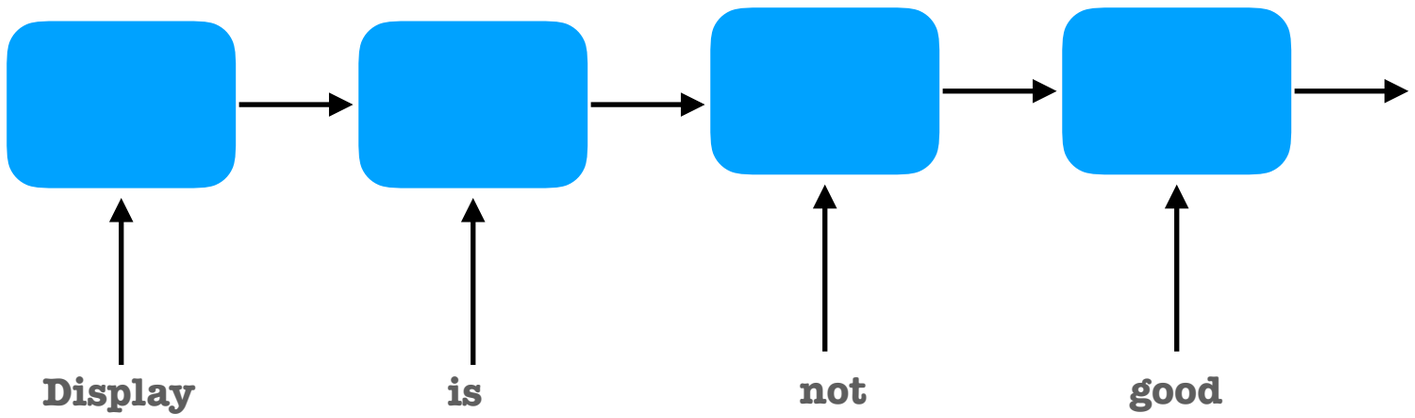
CV representation with context

Camera is very good	[[1, 0, 0, 0, 0, 0, 0, 0, 0, 0],	[0, 1, 0, 0, 0, 0, 0, 0, 0, 0],	[0, 0, 1, 0, 0, 0, 0, 0, 0, 0],	[0, 0, 0, 1, 0, 0, 0, 0, 0, 0]]
Battery is very bad	[[0, 0, 0, 0, 1, 0, 0, 0, 0, 0],	[0, 1, 0, 0, 0, 0, 0, 0, 0, 0],	[0, 0, 1, 0, 0, 0, 0, 0, 0, 0],	[0, 0, 0, 0, 0, 1, 0, 0, 0, 0]]
Screen is awesome	[[0, 0, 0, 0, 0, 0, 1, 0, 0, 0],	[0, 1, 0, 0, 0, 0, 0, 0, 0, 0],	[0, 0, 0, 0, 0, 0, 1, 0, 0, 0],	[0, 0, 0, 0, 0, 0, 0, 0, 0, 0]]
Display is not good	[[0, 0, 0, 0, 0, 0, 0, 0, 1, 0],	[0, 1, 0, 0, 0, 0, 0, 0, 0, 0],	[0, 0, 0, 0, 0, 0, 0, 0, 0, 1],	[0, 0, 0, 1, 0, 0, 0, 0, 0, 0]]

3. Feed-forward in RNN

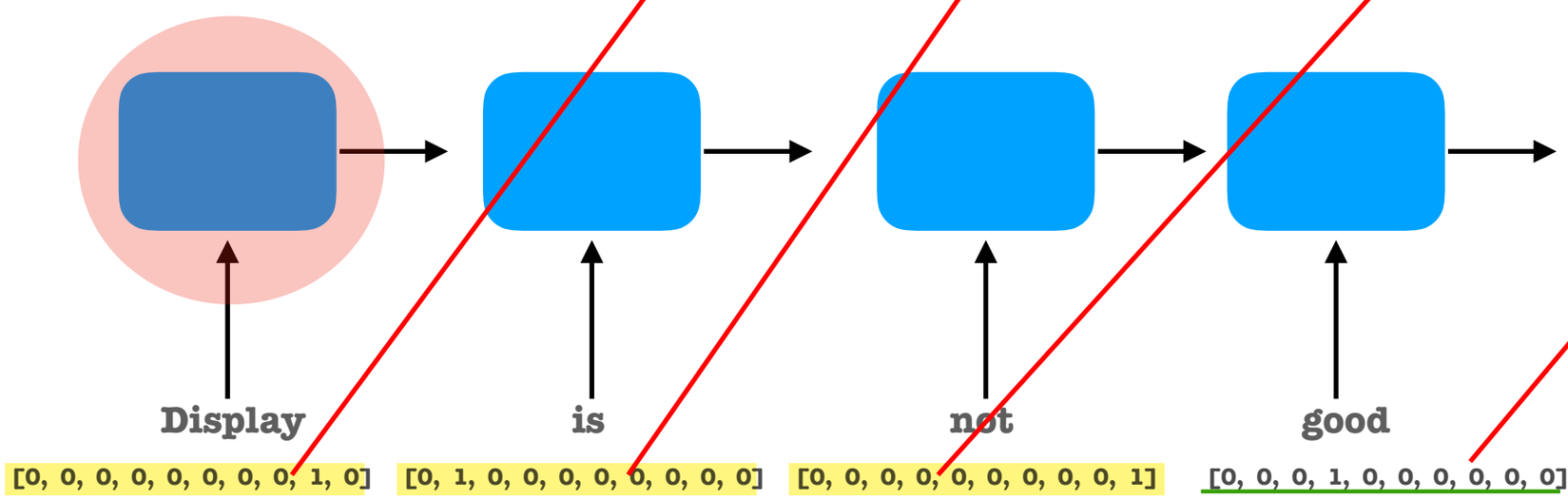
Now that we have represented sentence with context
Let's see how to feed it to RNN

Example: Display is not good

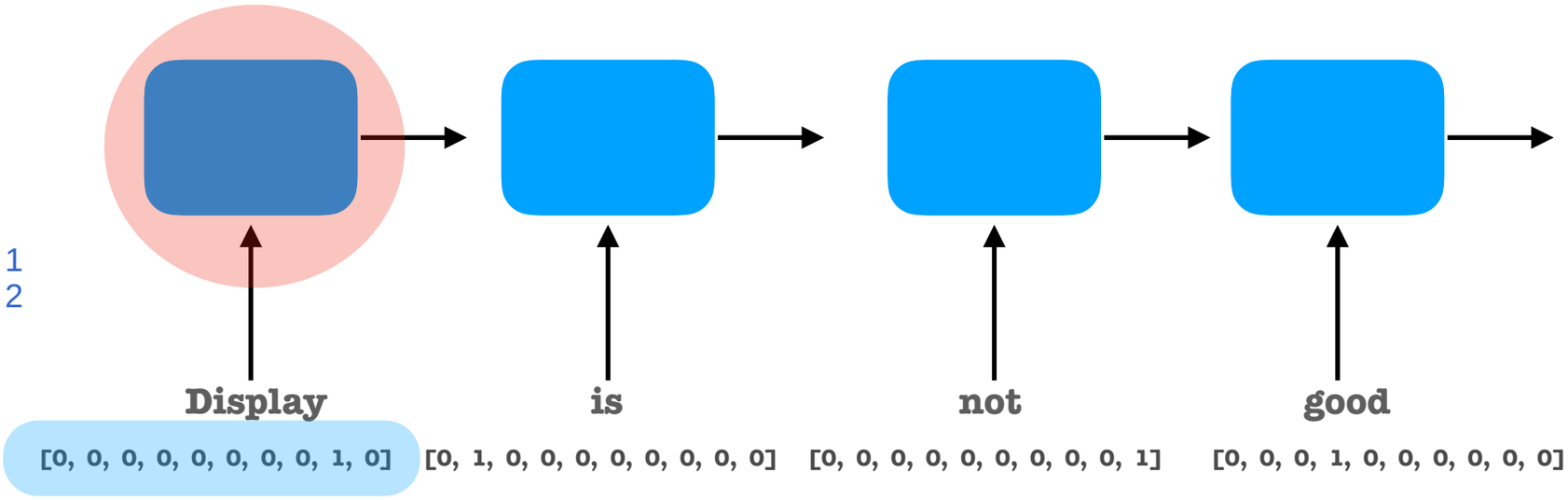


CV representation with context

Camera is very good	[[1, 0, 0, 0, 0, 0, 0, 0, 0, 0],	[0, 1, 0, 0, 0, 0, 0, 0, 0, 0],	[0, 0, 1, 0, 0, 0, 0, 0, 0, 0],	[0, 0, 0, 1, 0, 0, 0, 0, 0, 0]]
Battery is very bad	[[0, 0, 0, 0, 1, 0, 0, 0, 0, 0],	[0, 1, 0, 0, 0, 0, 0, 0, 0, 0],	[0, 0, 1, 0, 0, 0, 0, 0, 0, 0],	[0, 0, 0, 0, 0, 1, 0, 0, 0, 0]]
Screen is awesome	[[0, 0, 0, 0, 0, 0, 1, 0, 0, 0],	[0, 1, 0, 0, 0, 0, 0, 0, 0, 0],	[0, 0, 0, 0, 0, 0, 1, 0, 0, 0],	[0, 0, 0, 0, 0, 0, 0, 0, 0, 0]]
Display is not good	[[0, 0, 0, 0, 0, 0, 0, 0, 1, 0],	[0, 1, 0, 0, 0, 0, 0, 0, 0, 0],	[0, 0, 0, 0, 0, 0, 0, 0, 0, 1],	[0, 0, 0, 1, 0, 0, 0, 0, 0, 0]]

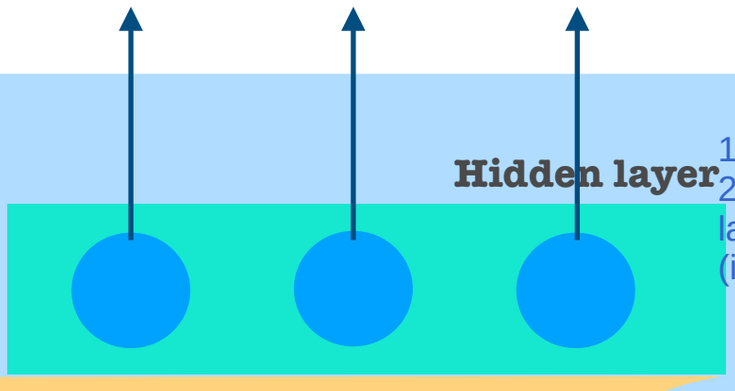


1- hidden layer
2- input layer
3- output layer
4- weight matrix 1
5- weight matrix 2



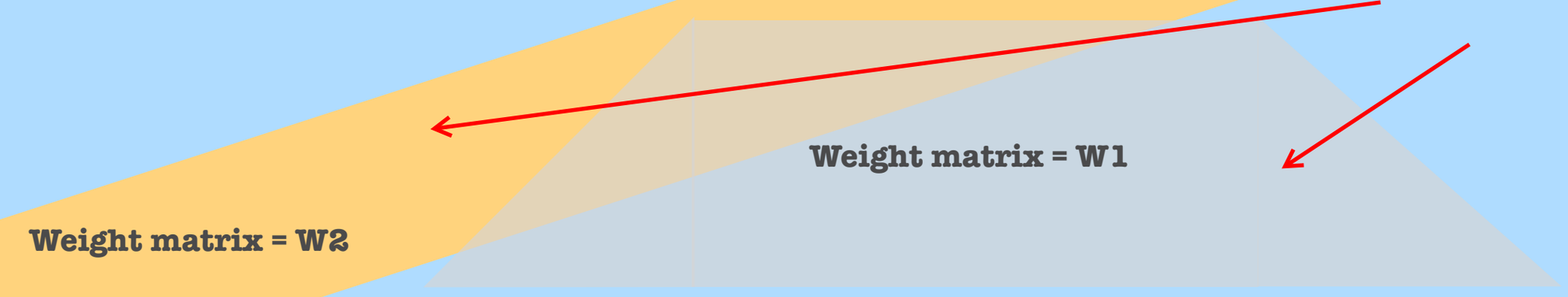
input layer = all unique vocabularies.

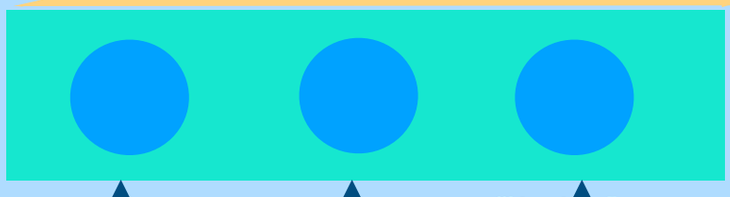
https://www.youtube.com/watch?v=zAPeAwiHy8E



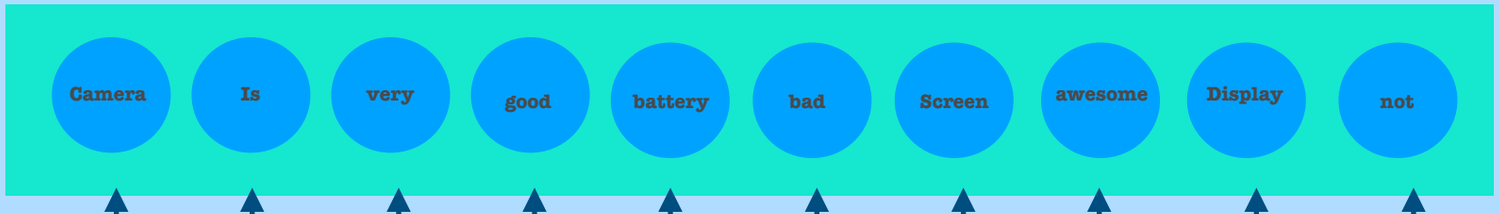
1- less then input layer
2- number of node in hiddern layer should be <= to 2/3 of (input + output)

fully connected net





State layer
state layer and hidden layer must be same



Input layer

0 0 0

Display = [0, 0, 0, 0, 0, 0, 0, 0, 1, 0]

Hidden layer

[0.8, 0.8, 0.8]

Context Vector
CV2

Weight matrix = W1

Weight matrix = W2

State layer

[0.0, 0.0, 0.0]

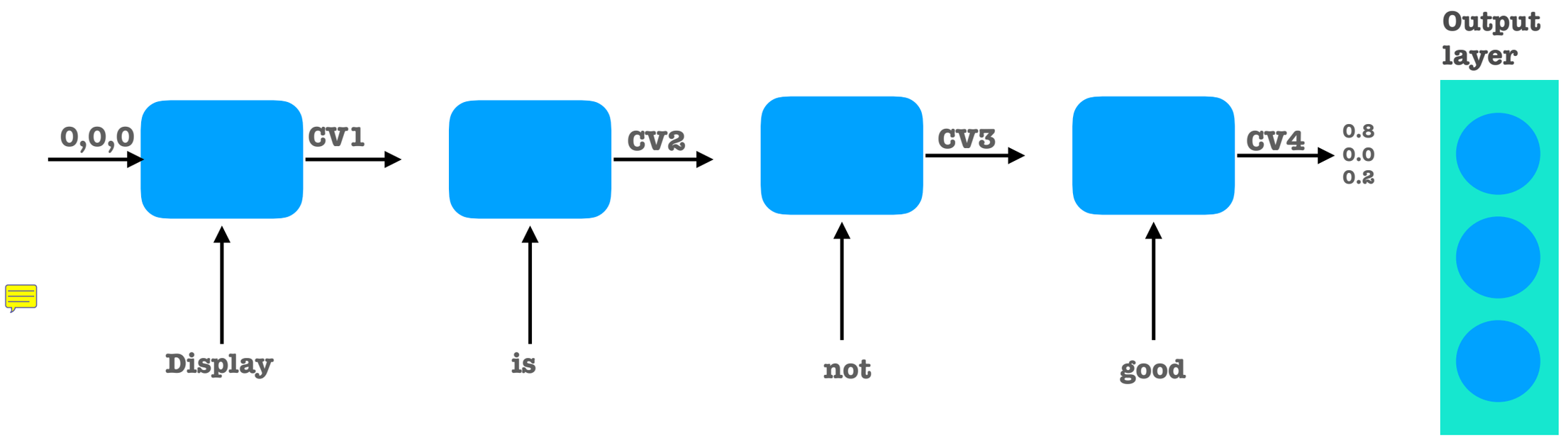
Input layer

update with context vecotor from vocabes each time.

[0, 0, 0, 0, 0, 0, 0, 0, 0, 0]

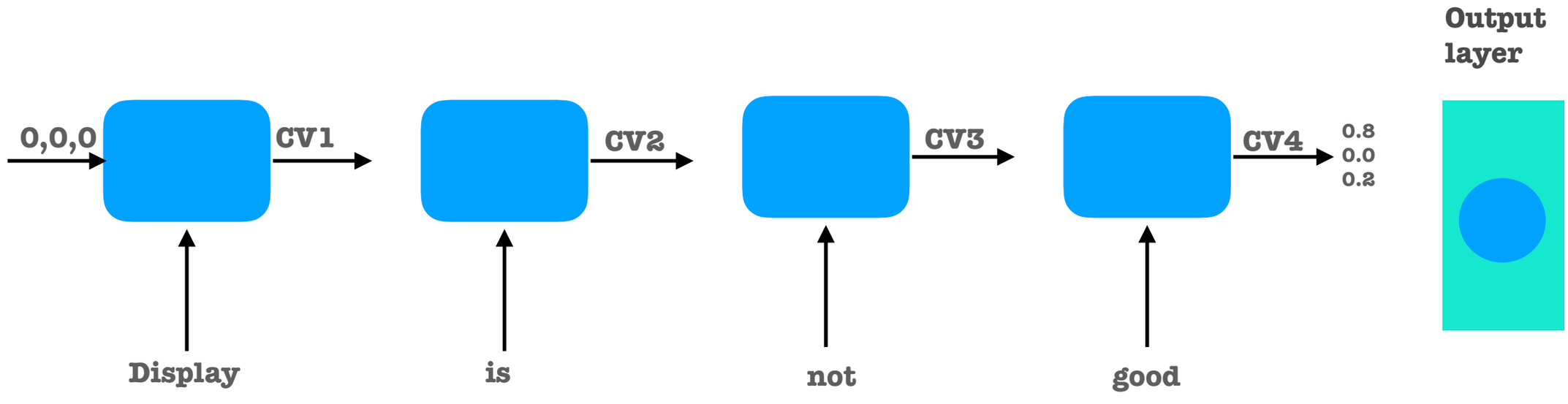
T1 T2 T3 T4

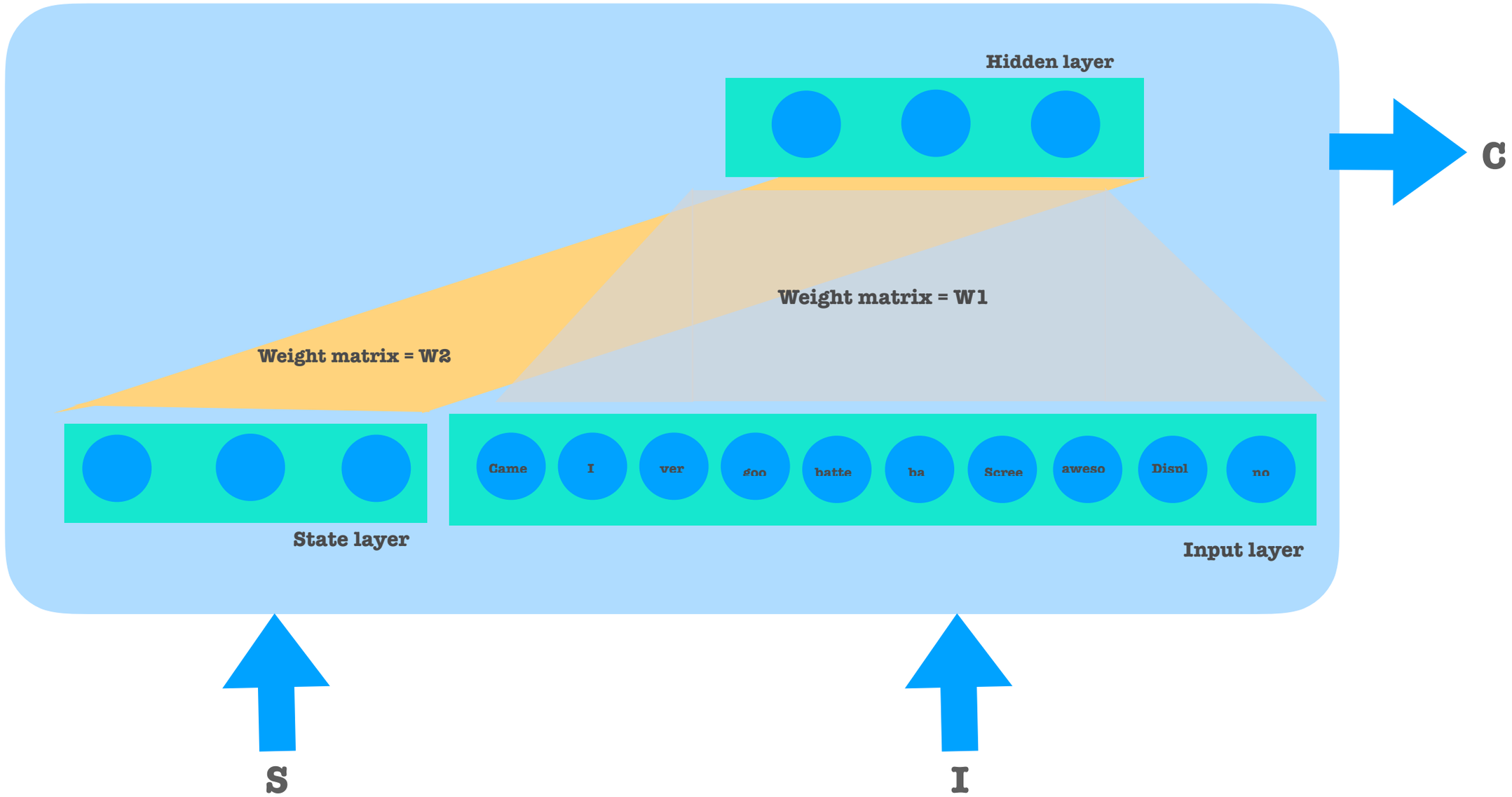
Display is not good



Training data

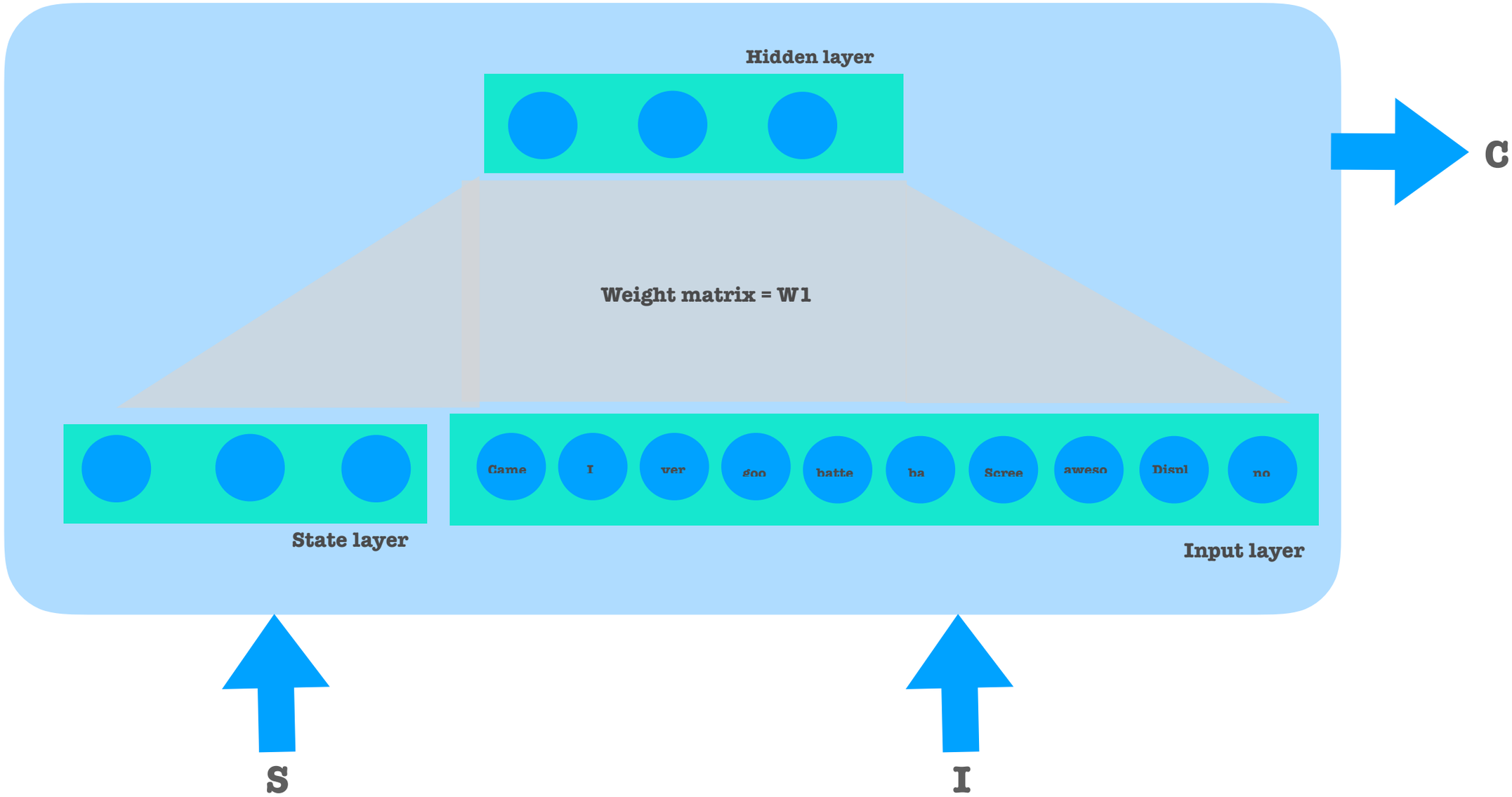
X_train	Y_train
Camera is very good	1
Battery is very bad	0
Screen is awesome	1
Display is bot good	0





$$C = F\left(\left[W1 * I + W2 * S\right] + b\right)$$

4 Variations in RNN



$$C = F\left(\left[W1 * I\right] + b\right)$$

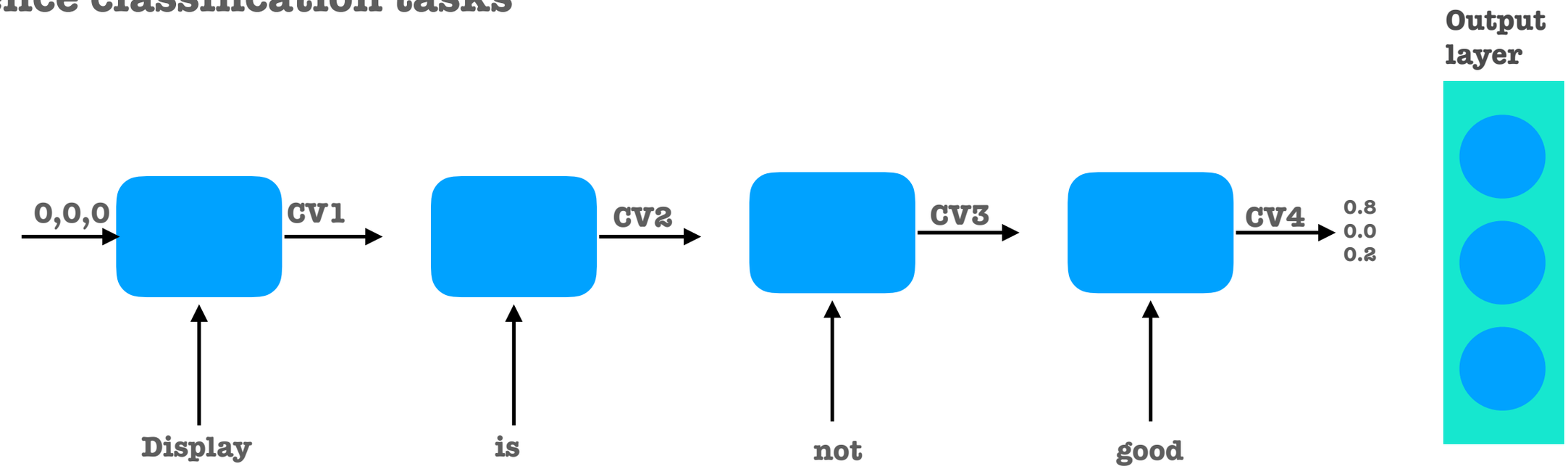
5.

5 Where we use RNN?

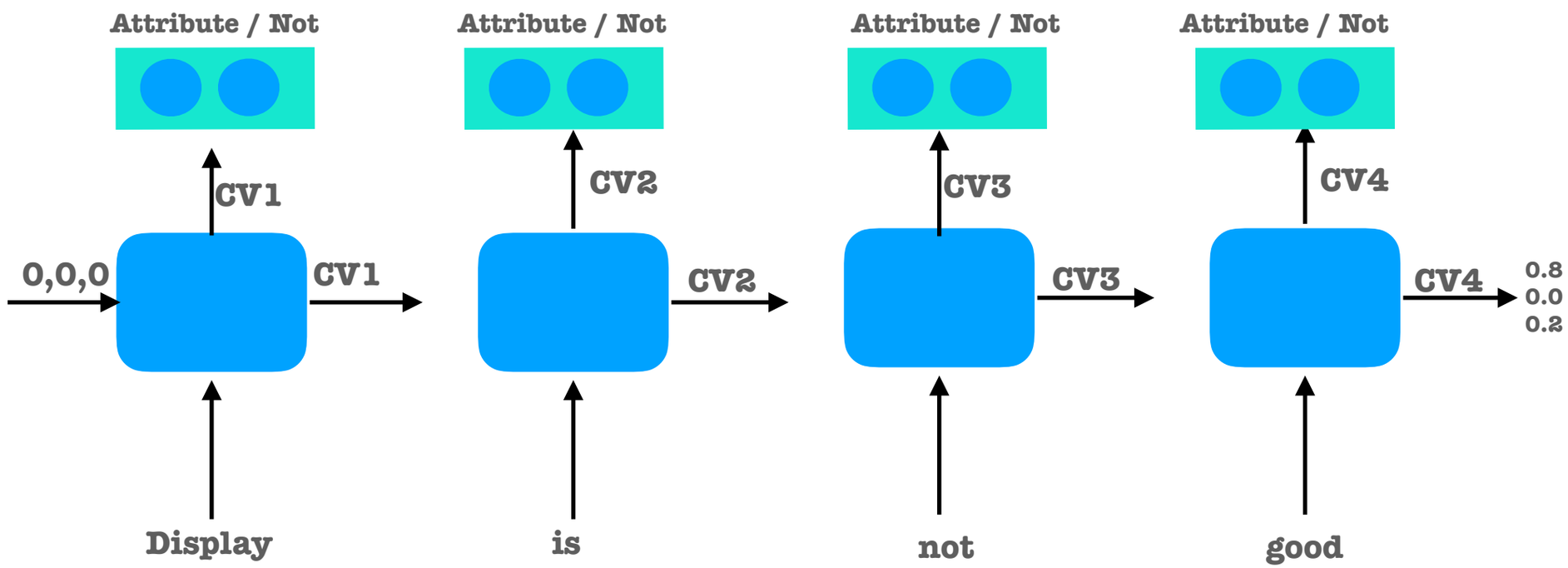
In what types of problems we use RNN?

1- Sequence tagging tasks
2- sequence classification task

Sequence classification tasks

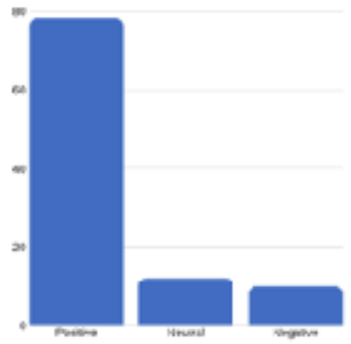


Sequence tagging tasks



How is the camera of iPhone X?

Product popularity

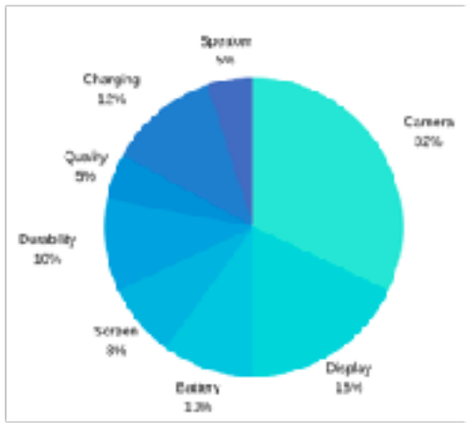


Product sentiment

Attribute model

Attributes:

- Camera
- Display
- Battery
- Screen
- Durability
- Quality
- Charging
- Speaker



Attribute popularity

Camera of this phone is very good and I fell in love with this phone...

URL: https://www.flipkart.com › ... › Apple iPhone 6s (Gold, 32 GB)

Summary: Camera is very good

● **positive**

Camera of this phone is very good and I fell in love with this phone...

URL: https://www.amazon.com › ... › Apple iPhone 6s (Gold, 32 GB)

Summary: Camera is very good

● **positive**

Camera of this phone is very good and I fell in love with this phone...

URL: https://www.snapdeal.com › ... › Apple iPhone 6s (Gold, 32 GB)

Summary: Camera is very good

● **negative**

Camera of this phone is very good and I fell in love with this phone...

URL: https://www.amazon.com › ... › Apple iPhone 6s (Gold, 32 GB)

Summary: Camera is very good

● **neutral**

	product_description	meta_description	description	bread_crumb	highlights	formated_reviews
0	NaN	Buy Moto G5s (Lunar Gray, 32 GB) online at bes...	NaN	Home > Mobiles & Accessories > Mobiles > Motor...	[]	['Nice Good but over priced', 'Absolute rubbis...
1	NaN	Buy Imported ShengShow Gold Mirror Rubik Magic...	Very Good Fantastic Product. No compromise on ...	Home > Toys > Puzzles & Board Games > Puzzles ...	[]	['Really Nice Smooth', 'Excellent It is a good...
2	A revolutionary camera that adapts like the hu...	Buy Samsung Galaxy S9 (Midnight Black, 128 GB)...	Galaxy S9 Sleek and stunning the latest flagsh...	Home > Mobiles & Accessories > Mobiles > Samsu...	[]	['Must buy! Just woww', 'Fakruddin Nice Produc...

Feature engineering in text

Nouns **Nouns** **Nouns** **Nouns** **Nouns** **Nouns**

Review 1 : Iphone x, camera, one, store, home, features.

Review 2 : Samsung s9, phone, sound quality, build

Review 3 : Hello guys, shirt, Amazon, price, kidney, order

Review 4 : shirt, material, Texture, style, brand

5 **TF IDF**

6 **NMF**

Topics

1. Representing samples with context using CV
2. Padding in samples
3. Feed-forward in RNN
4. Variations in RNN
5. Where we use RNN?