NLP Pre-Transformers

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Working with text

- Working with Neural Networks requires inputs in numerical representation
  - Character based representation (e.g., ascii code)
  - Word based encoding (each word a different representation)
    - Dictionary with all possible words; representation is based on the position on this dictionary

```
from tensorflow.keras.preprocessing.text import Tokenizer
sentences = [‘Messi is the best player in the world’, ‘Barcelona
is the best team in the world’]
tokenizer = Tokenizer(num_words=100)
tokenizer.fit_on_texts(sentences)
print(tokenizer.word_index)
{'the': 1, 'is': 2, 'best': 3, 'in': 4, 'world': 5, 'messi': 6,
'player': 7, 'barcelona': 8, 'team': 9}
```

Working with text

- Alternative representation: One Hot Encoding
  - Vector of the dictionary length, with all components to 0 except 1
- Assuming the following dictionary

```
{'the': 1, 'is': 2, 'best': 3, 'in': 4, 'world': 5, 'messi':
6, 'player': 7, 'barcelona': 8, 'team': 9}
```

  - The word Messi would be represented by the vector

    [0 0 0 0 0 1 0 0 0]

  - The word player by

    [0 0 0 0 0 0 1 0 0]

  - The word the by

    [1 0 0 0 0 0 0 0 0]

Text to Sequences

- A sequence (i.e., a sentence) is simply a list of (ordered) tokens
- Previous idea could be used for representing sentences

```
{'the': 1, 'is': 2, 'best': 3, 'in': 4, 'world': 5,
'messi': 6, 'player': 7, 'barcelona': 8, 'team': 9}
```

- The sentence ‘Messi is the best player in the world’ can be represented as the array

  [6, 2, 1, 3, 7, 4, 1, 5]

- And the sentence ‘Barcelona is the best team in the world’ can be represented as the array

  [8, 2, 1, 3, 9, 4, 1, 5]

tokenizer.texts_to_sequences([str])

Text to Sequences

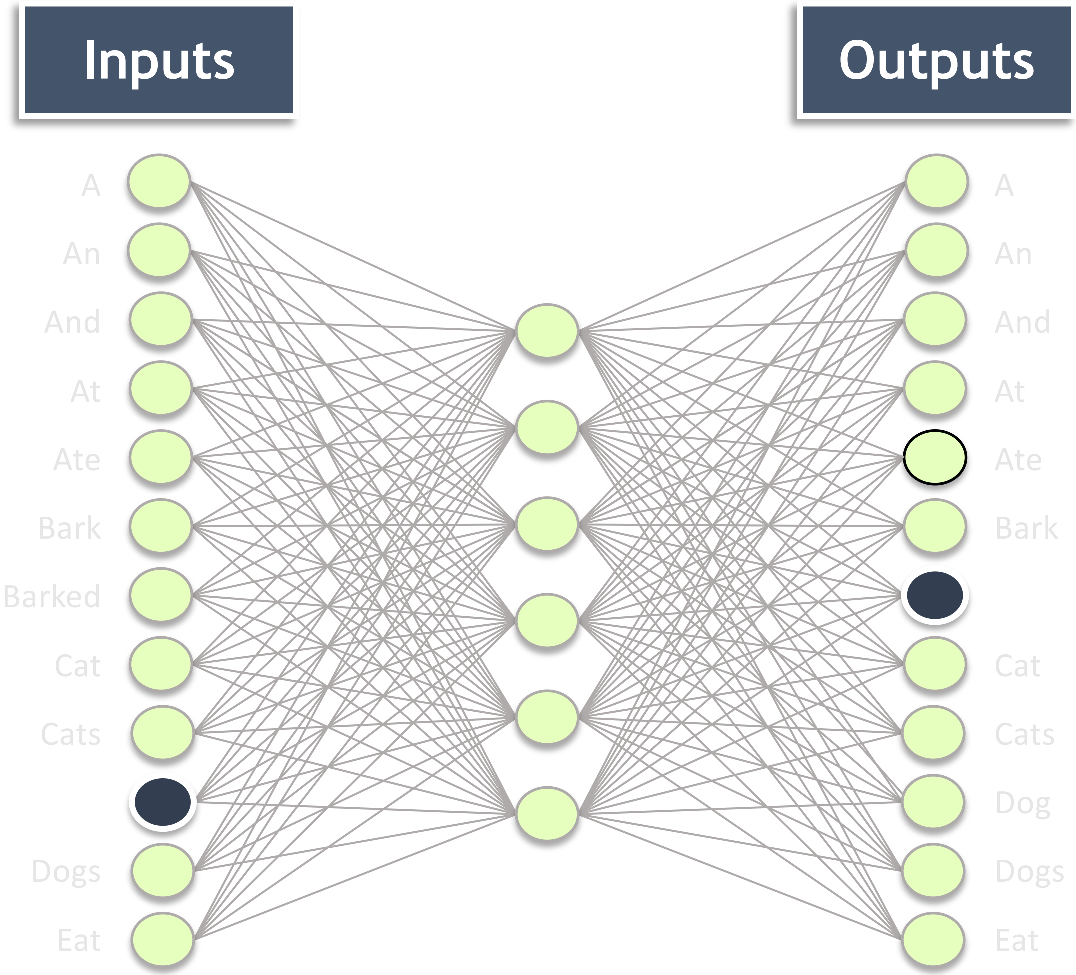
- Alternatively, if the One Hot Encoding has been chosen, given the dictionary

```
{'the': 1, 'is': 2, 'best': 3, 'in': 4, 'world': 5, 'messi': 6,
'player': 7, 'barcelona': 8, 'team': 9}
```

- The sentence ‘Messi is the best player in the world’ can be represented as the matrix

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

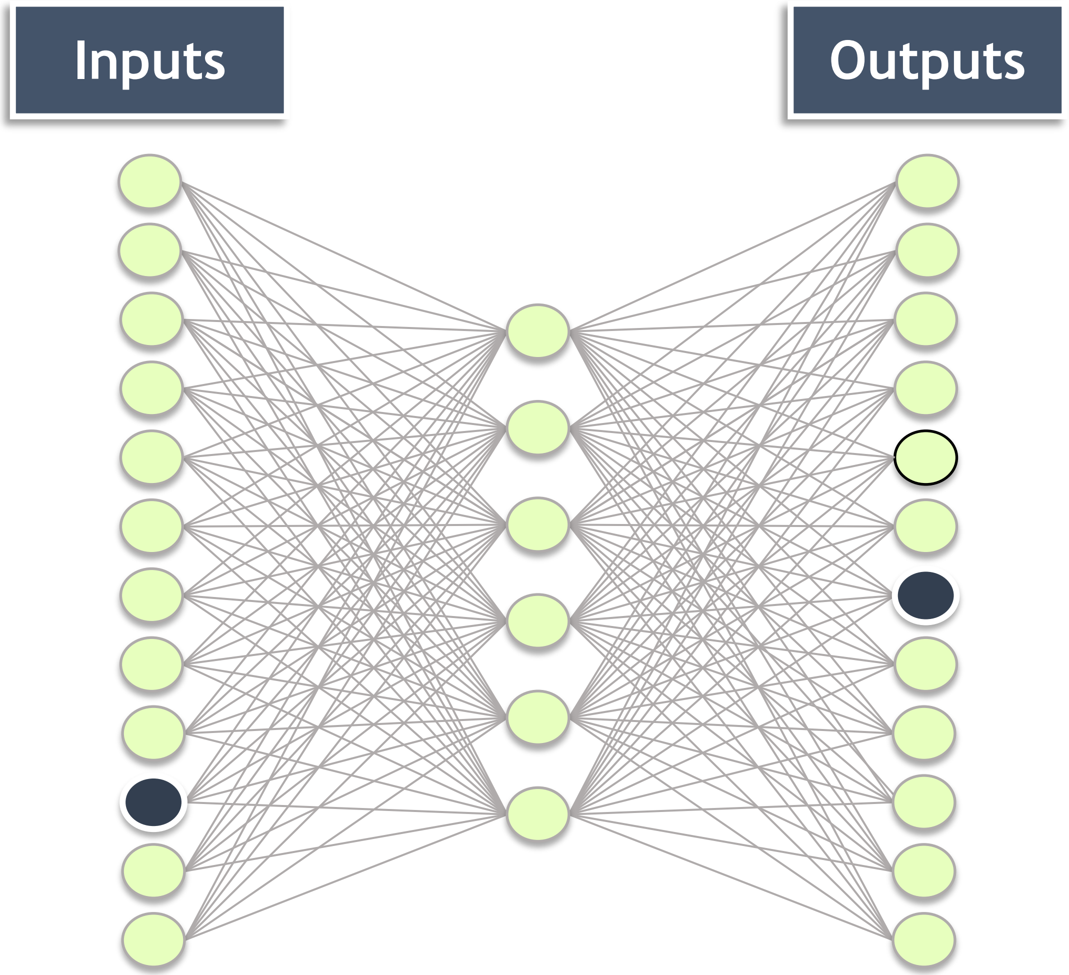
From Words to Numbers



Dictionary

1. A
2. An
3. And
4. At
5. Ate
6. Bark
7. Barked
8. Cat
9. Cats
10. Dog
11. Dogs
12. Eat

From Words to Numbers



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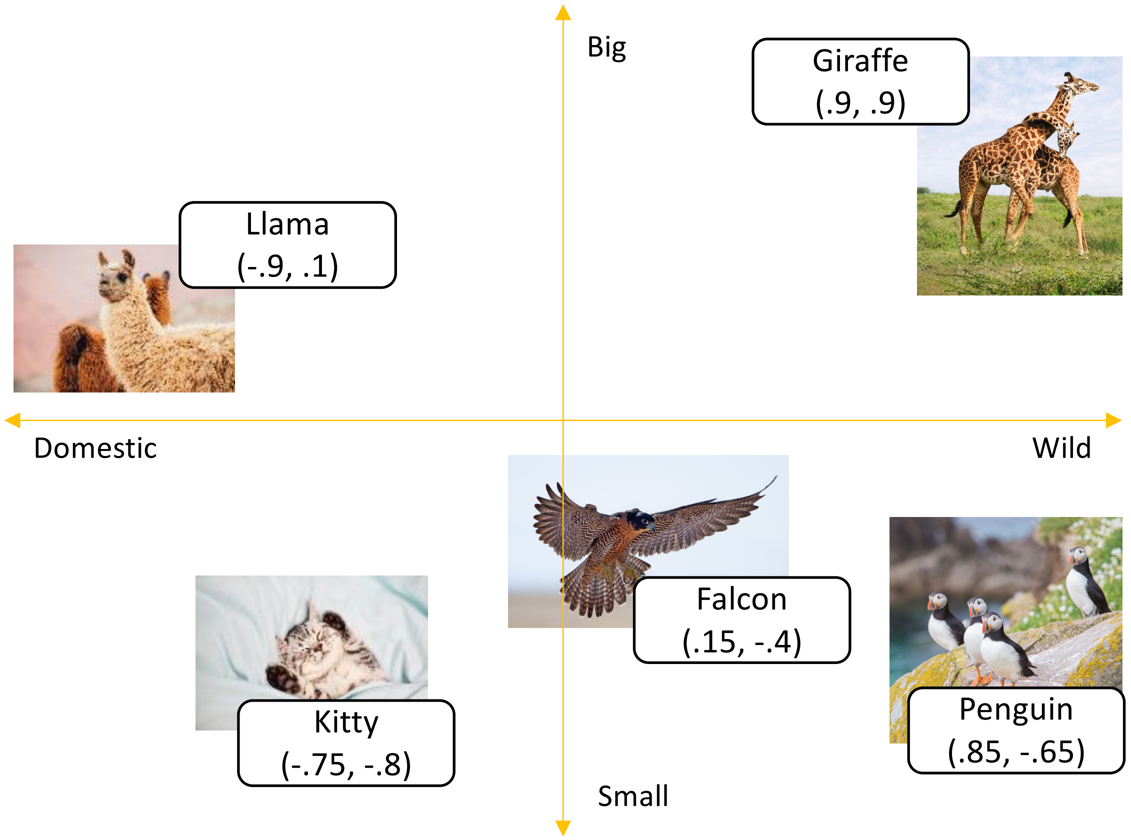

Bigger Dictionary

1. A
2. An
3. And
4. At
5. Ate
6. Bark
7. Barked
8. Cat
9. Cats
10. Dog
11. Dogs
12. Eat
13. Eaten
14. A
15. An
16. And
17. At
18. Ate
19. Bark
20. Barked
21. Cat
22. Cats
23. Dog
24. Dogs
25. Eat
26. Eaten
27. A
28. An
29. And
30. At
31. Ate
32. Bark
33. Barked
34. Cat
35. Cats
36. Dog
37. Dogs
38. Eat
39. Eaten
40. A
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42. And
43. At
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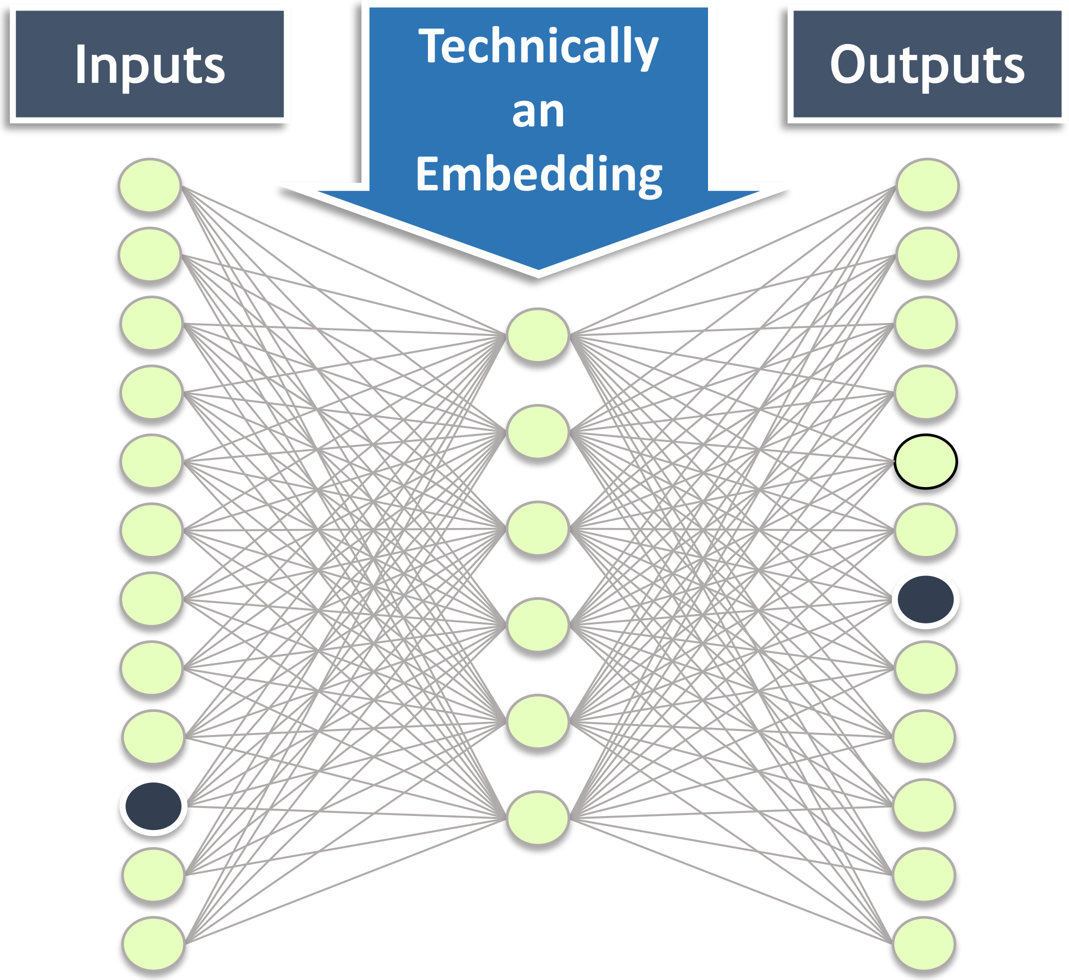
61. Cats
62. Dog
63. Dogs
64. Eat
65. Eaten
66. A
67. An
68. And
69. At
70. Ate
71. Bark
72. Barked
73. Cat
74. Cats
75. Dog
76. Dogs
77. Eat
78. Eaten
79. …
80. …
81. …
82. …

From Words to Numbers



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Recurrent Neural Networks

Learning From Text

- If you read the partial sentence:
  - Today there is an amazing blue …
- What do you think of next?

Learning From Text

- If you read the partial sentence:
  - Today there is an amazing blue …
- What do you think of next?
  - Today there is an amazing blue sky.

Learning from Text

- If you read the partial sentence:
  - She was born in Munich, therefore at school the primary language was ….
- In contrast to the previous example, the word that influences what we need to predict now is not the previous was, but was way beyond in the text
  - Do RNN still help in this case?

Recurrent Neural Networks

“Cats say ___.”

“Dogs say ___.”

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2. Dogs
3. Meow
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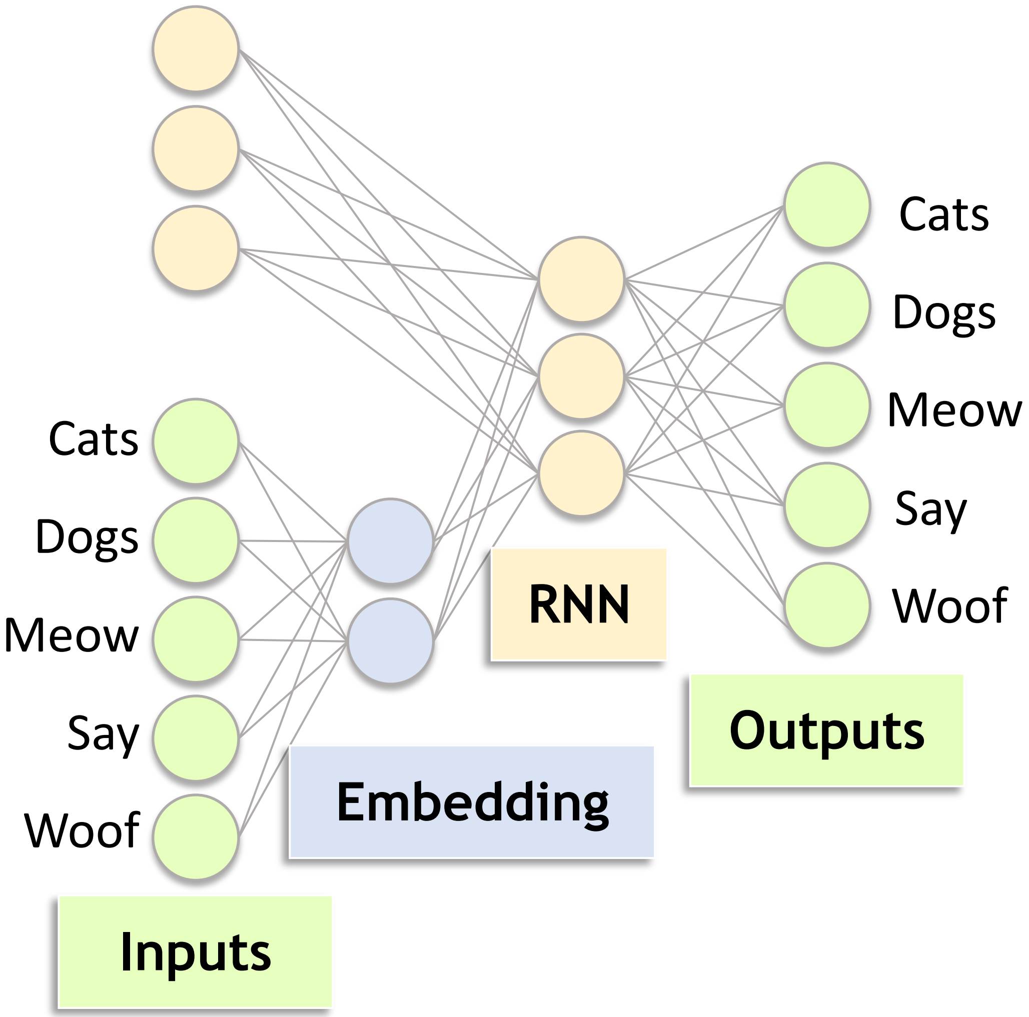
Recurrent Neural Networks



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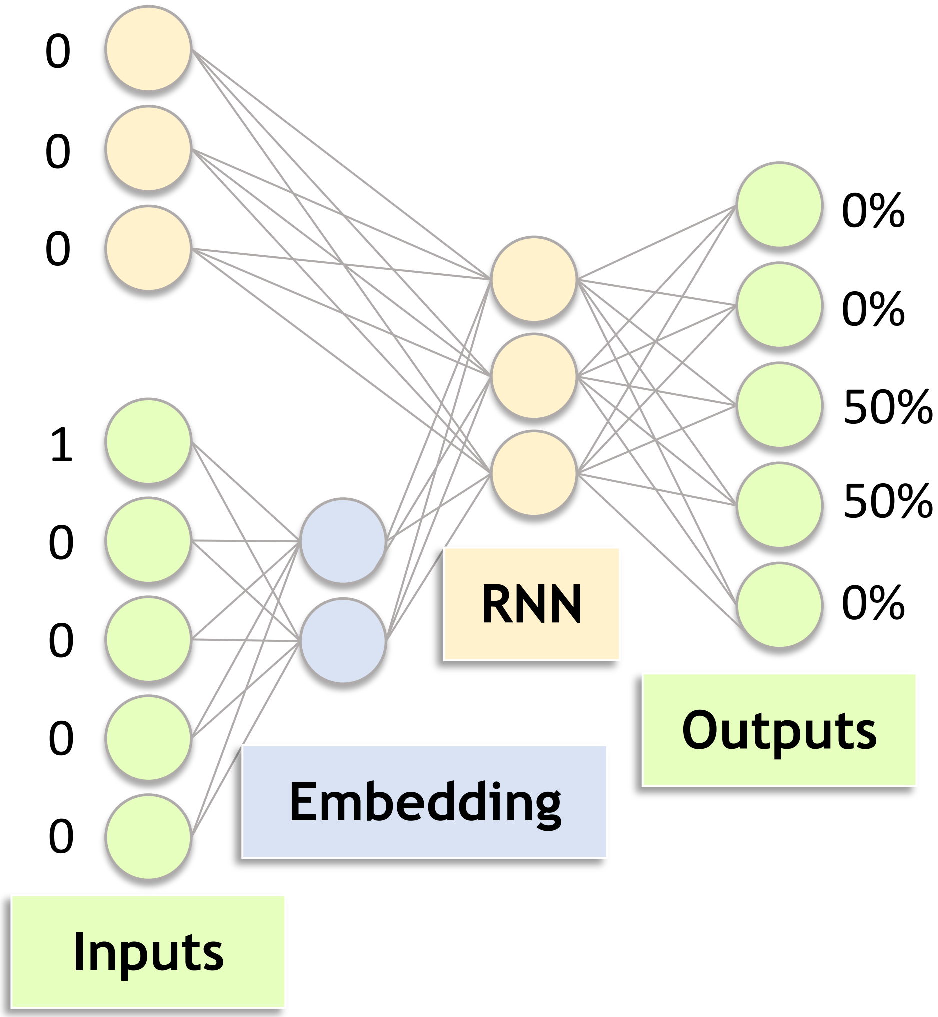

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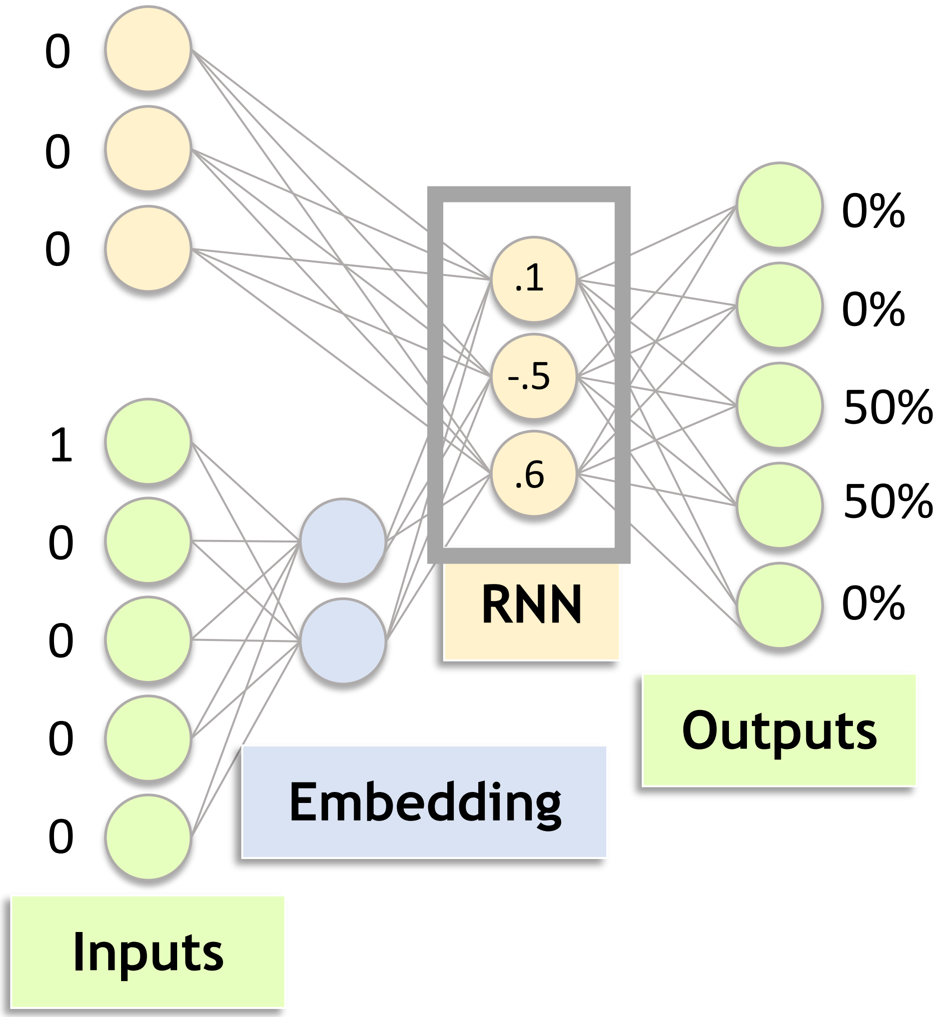

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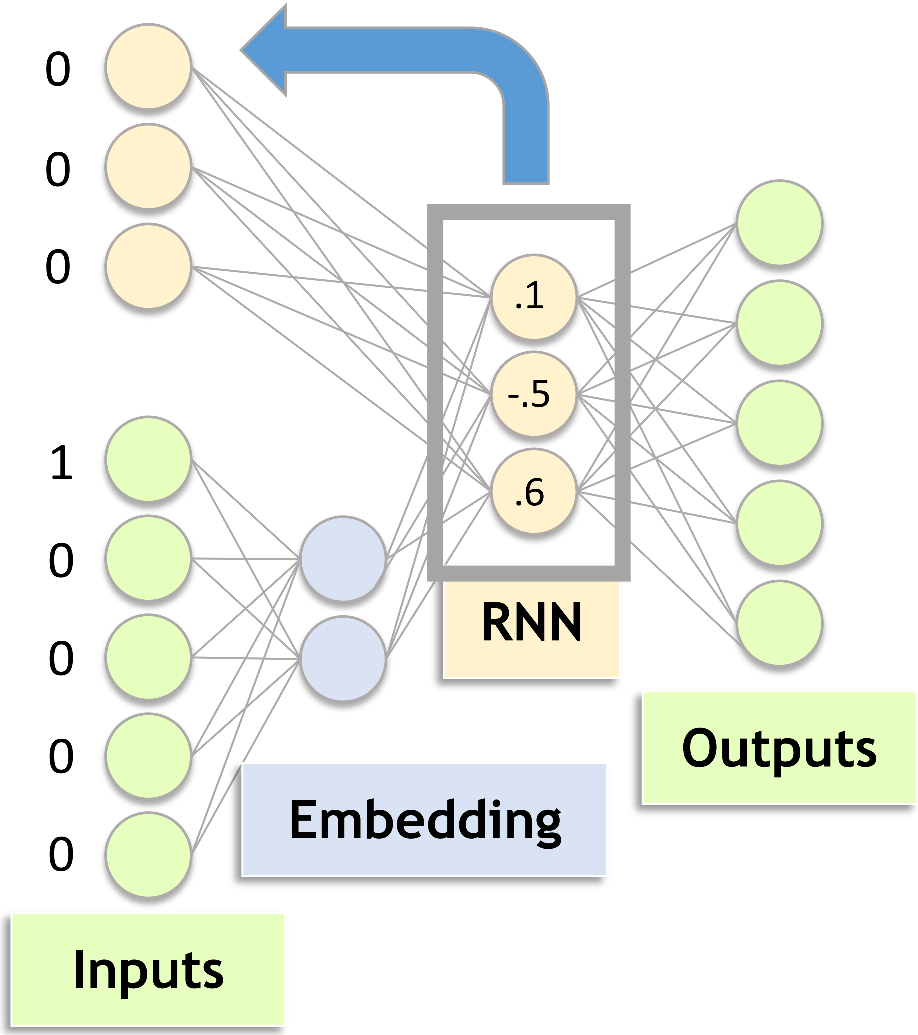

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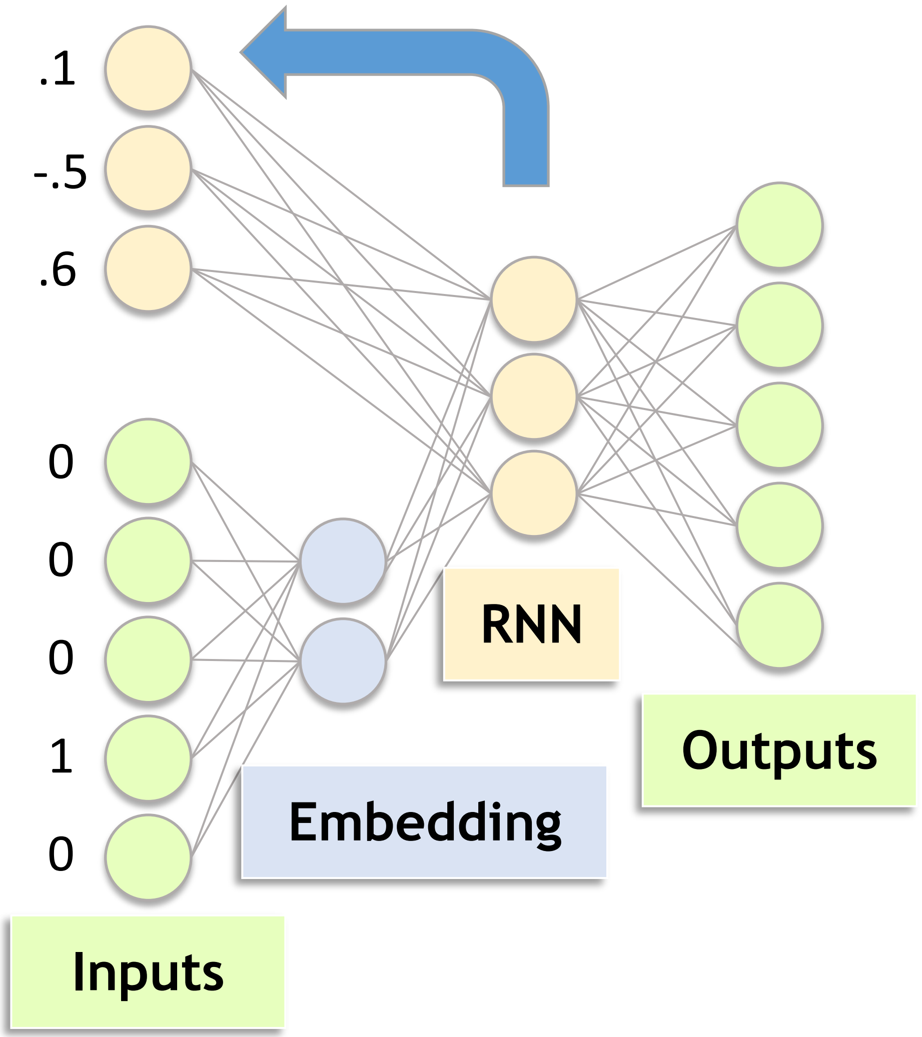

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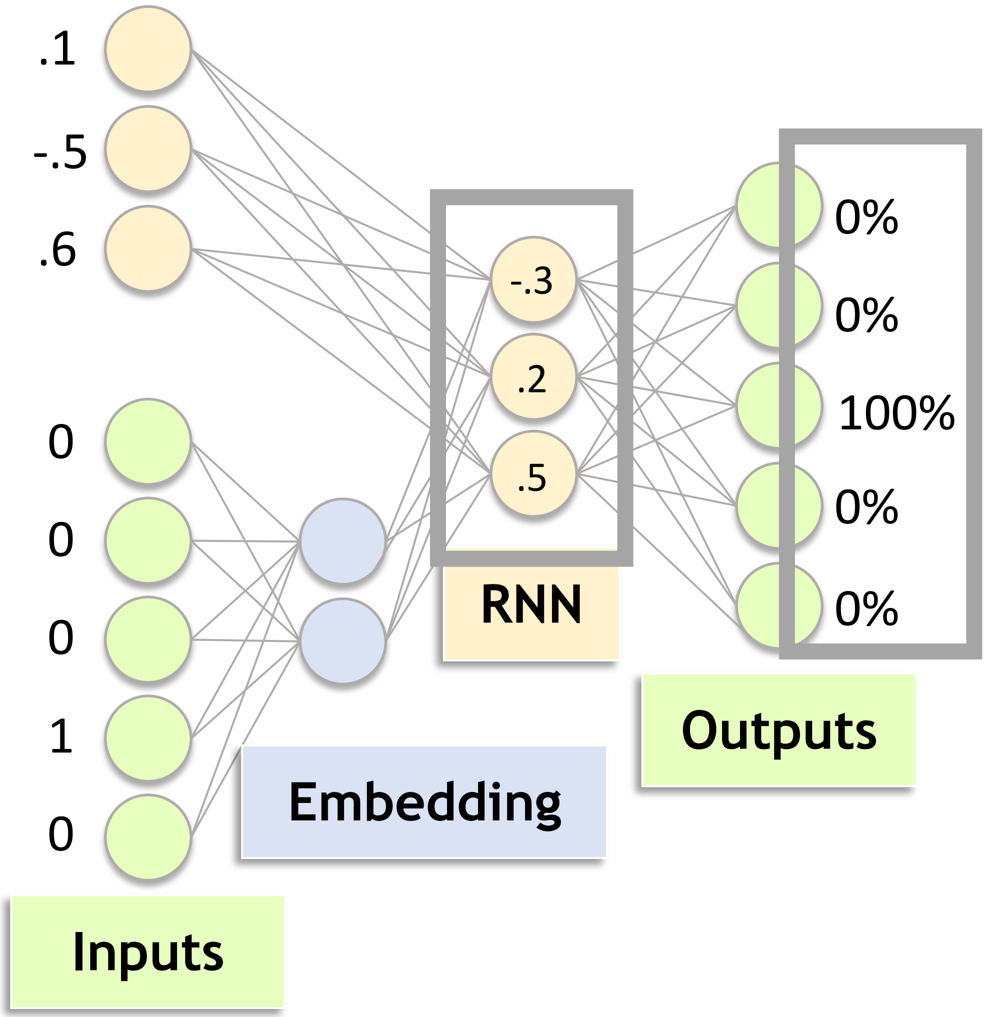

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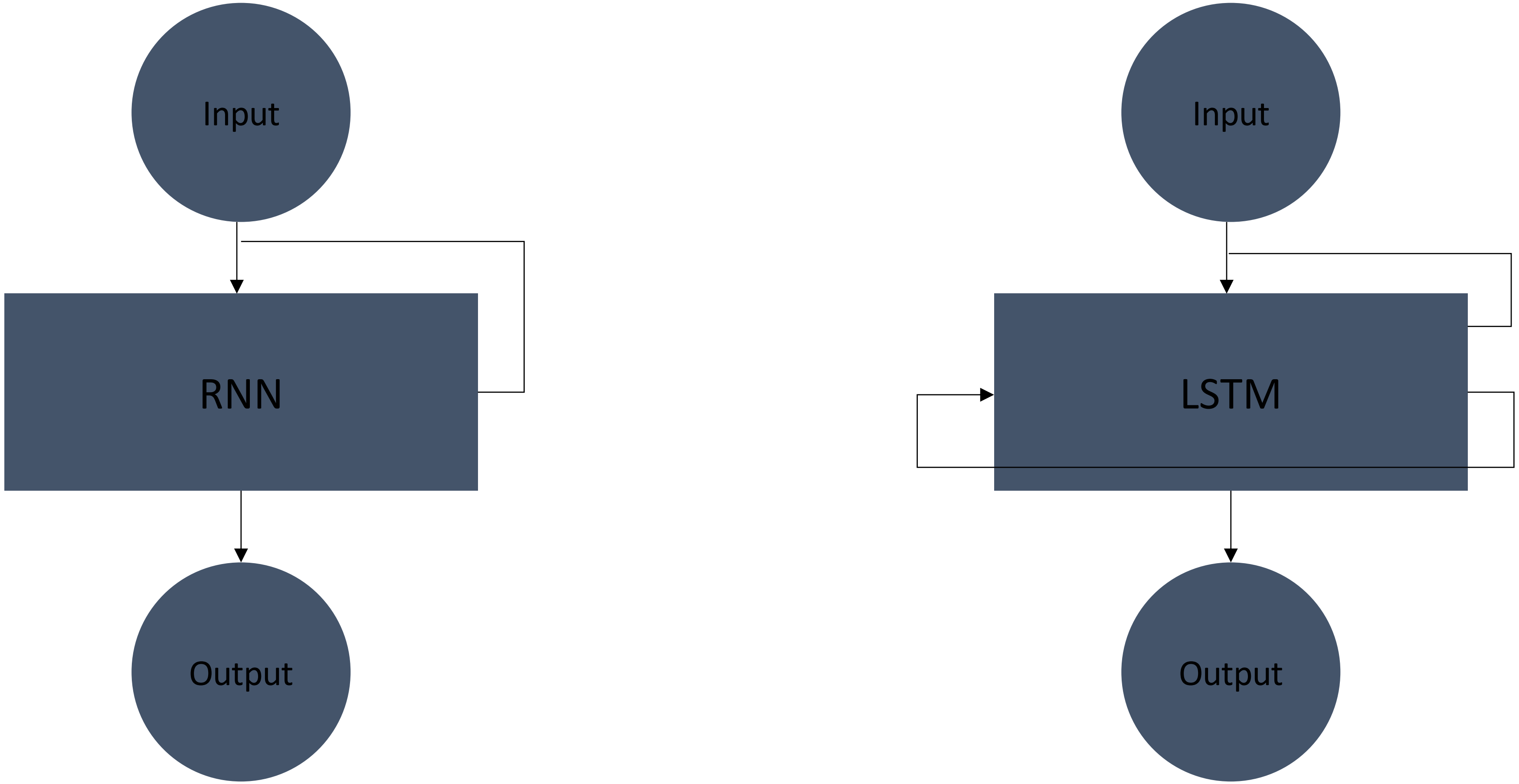
Input
RNN
Output
Input
LSTM
Output