Sequence Models

<u>Examples</u>

- Speech recognition
- Music generate
- Sentiment Classification (pos/neg, emotion)
- Genomic sequence classification (A A A A T C A G C)
- Machine translation (Spanish $\longmapsto$ English)
- Named Entity Recognition (Given a sentence determine the entities)

<u>Sequence Model</u> : Special type of models (neural networks mostly) that take into account the sequence structure.

Recurrent Neural Network (RNN)

Sentence: "$x^{(1)}$ $x^{(2)}$ $x^{(3)}$ $x^{(4)}$ $x^{(5)}$ $x^{(6)}$ $x^{(7)}$ ← Words

Grapes are the best fruit in existence."

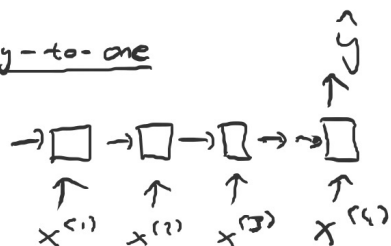① Word embeddings : Converting words to vector of numbers.
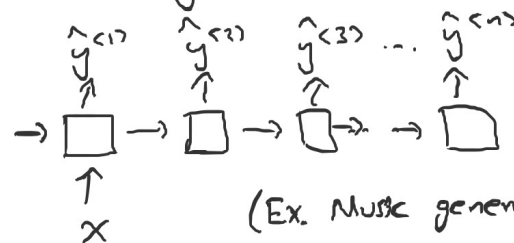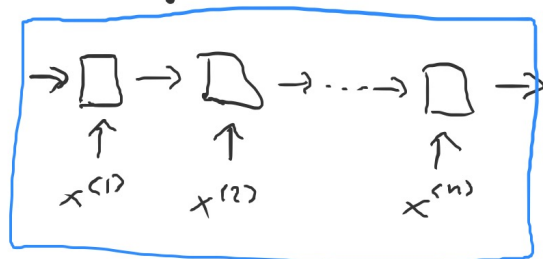
② The RNN Architecture :

RNN

"Backpropagation through time" error $(y - \hat{y})$ — How bad did network do?

prediction positive!

$F(a^{<6>}, x^{<7>})$ Forward propagation

$a^{<0>}$ $a^{<1>}$ $F(a^{<1>}, x^{<2>})$ $F(a^{<2>}, x^{<3>})$ $a^{<2>}$

"hidden state" ↓ Context!!

$x^{<1>}$ $x^{<2>}$ $x^{<3>}$ $x^{<4>}$ $x^{<5>}$ $x^{<6>}$ $x^{<7>}$

Grapes are the best fruit in existence

$Wx + b$ → parameters
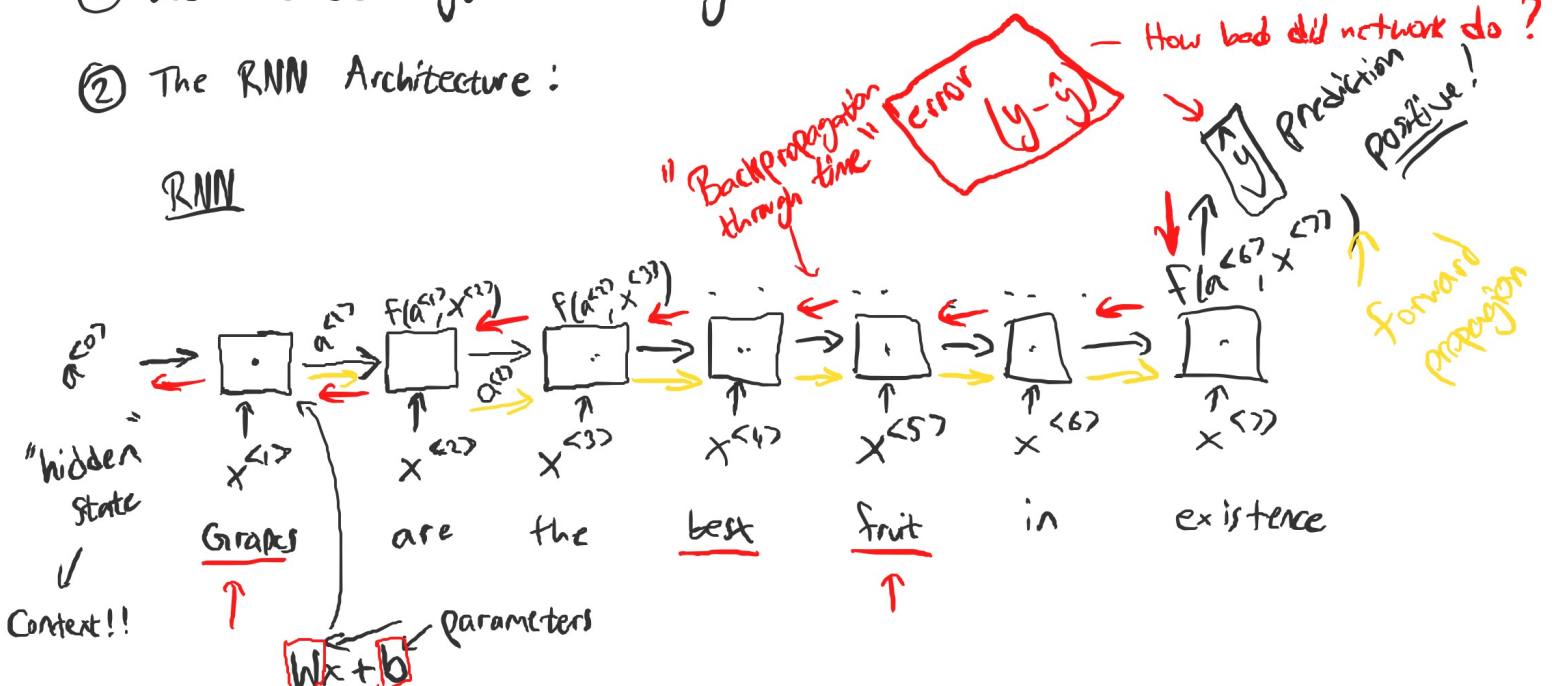
Types of RNNs

Many-to-one

$x^{(1)}$ $x^{(2)}$ $x^{(3)}$ $x^{(4)}$

(Ex. Sentiment Classification)

One-to-many

$\hat{y}^{<1>}$ $\hat{y}^{<2>}$ $\hat{y}^{<3>}$ ... $\hat{y}^{<n>}$

x

(Ex. Music generation)

Many-to-many

$x^{(1)}$ $x^{(2)}$ $x^{(n)}$

Encoder

↑ English

Spanish

Decoder

Ex. Machine translation