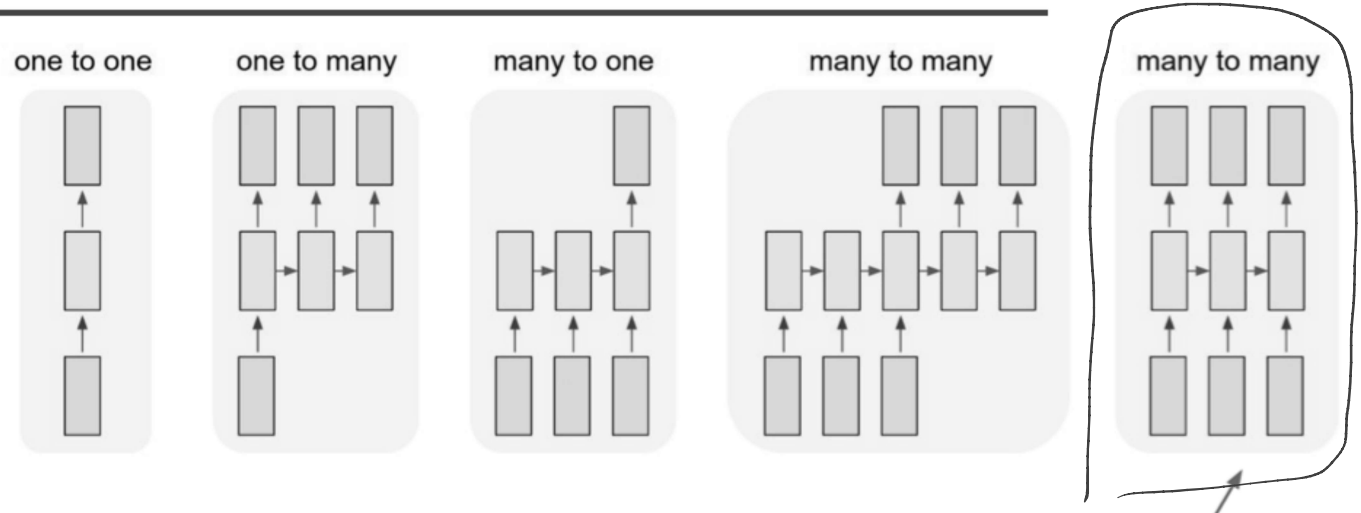
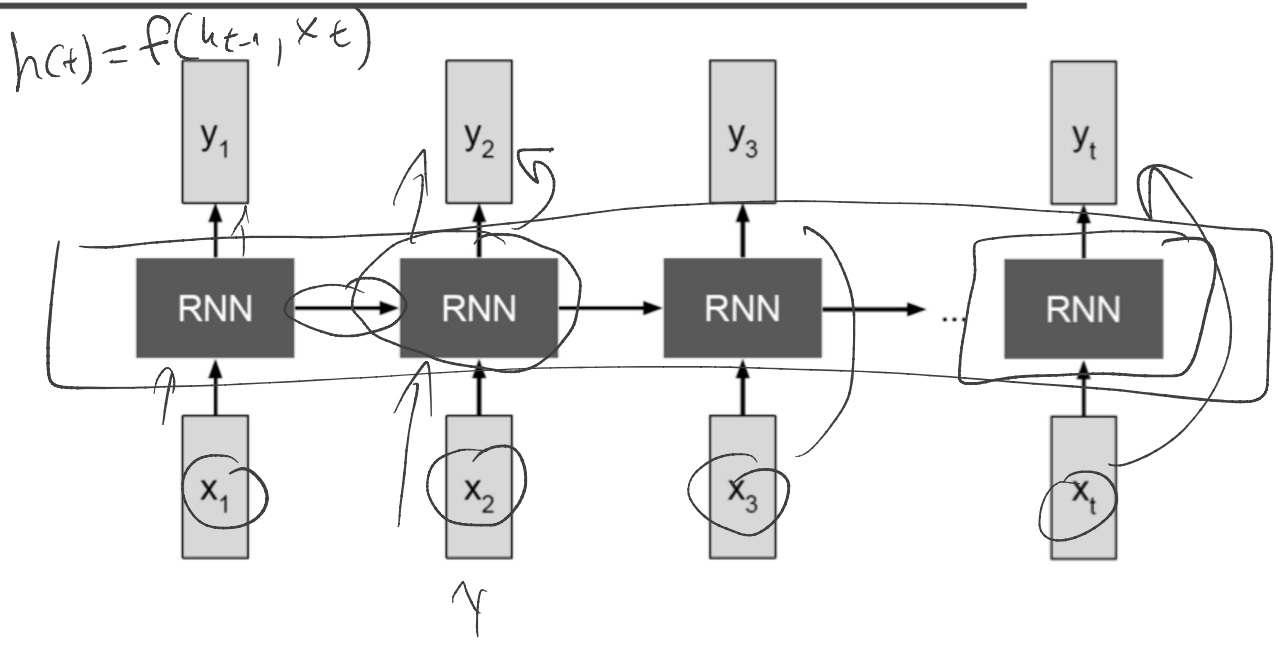
Recurrent Neural Networks

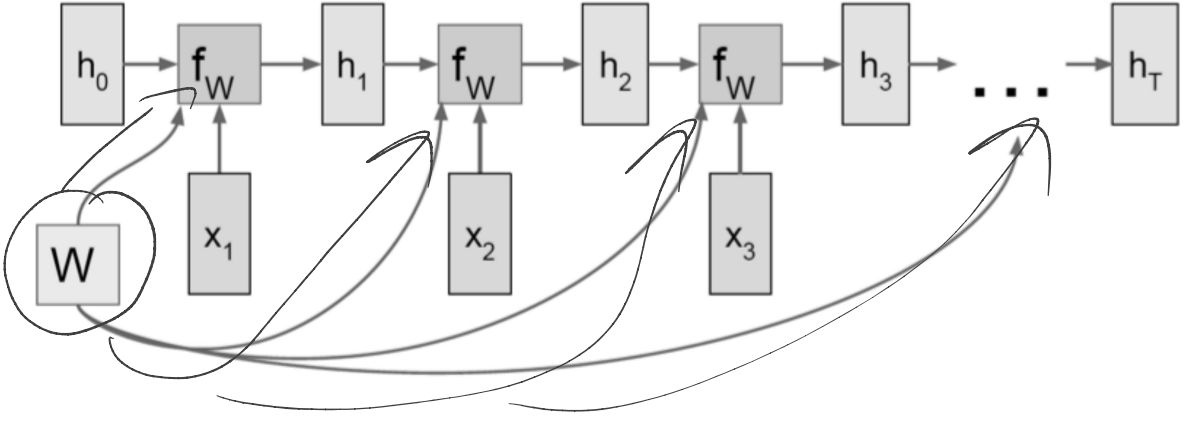


Recurrent Neural Networks

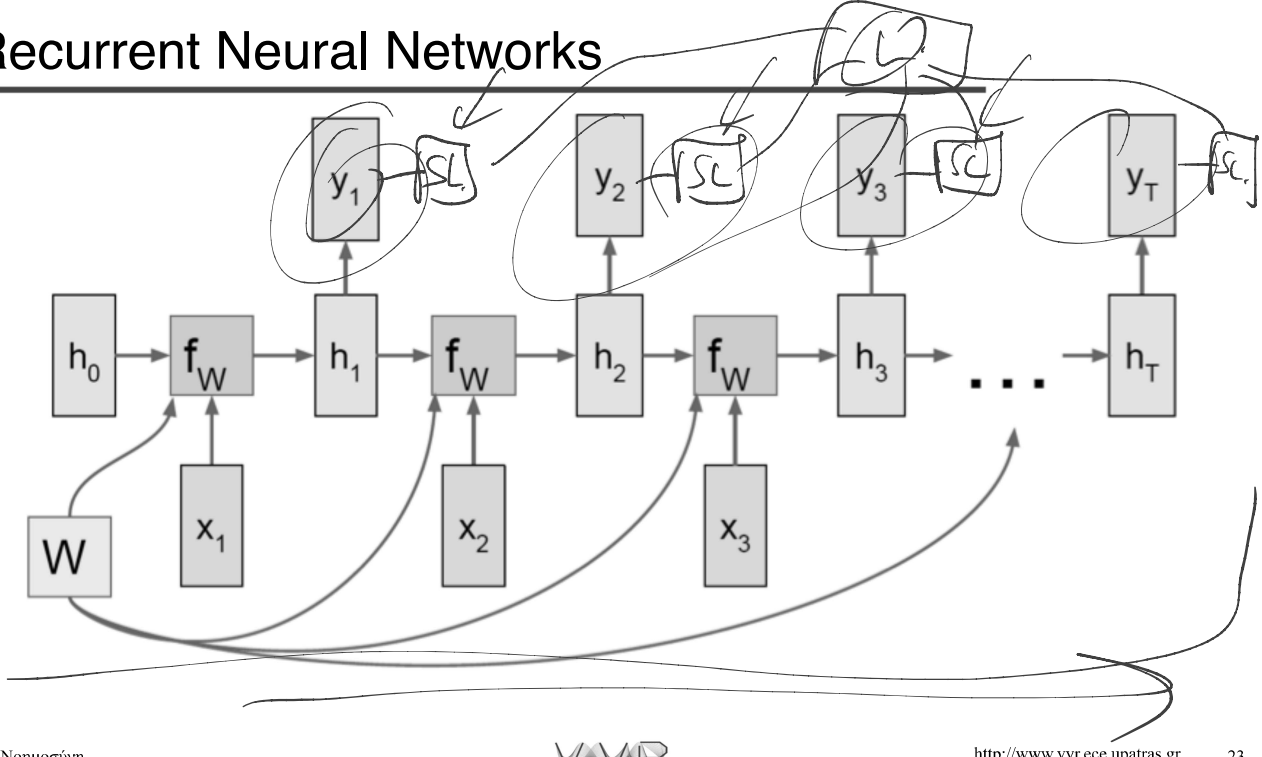


Recurrent Neural Networks

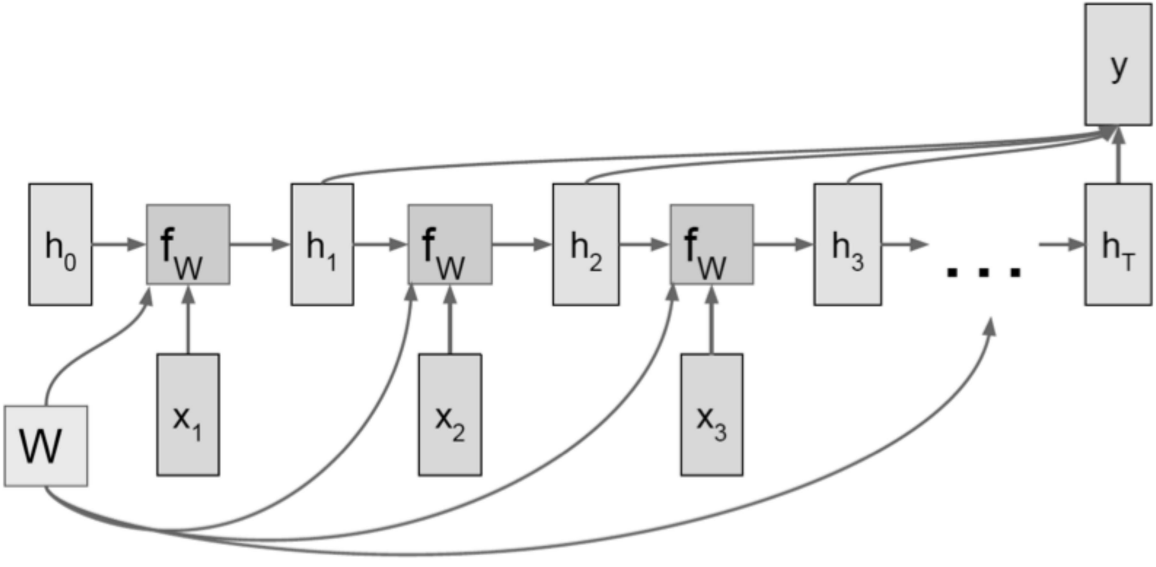
Re-use the same weight matrix at every time-step



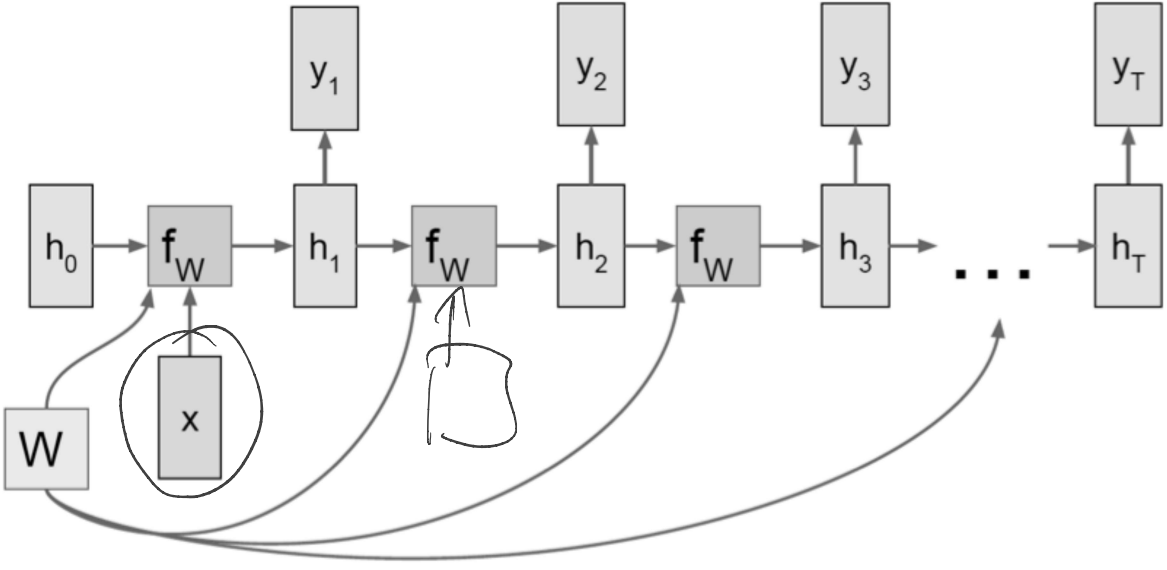
Recurrent Neural Networks



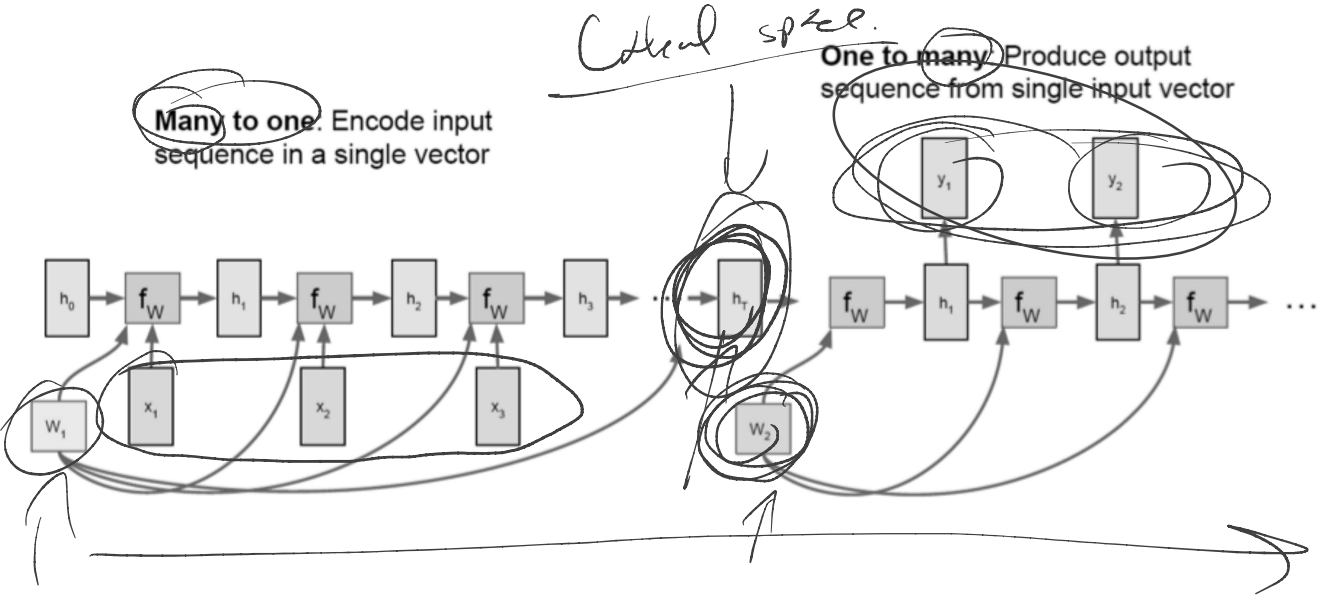
Recurrent Neural Networks



Recurrent Neural Networks



Recurrent Neural Networks

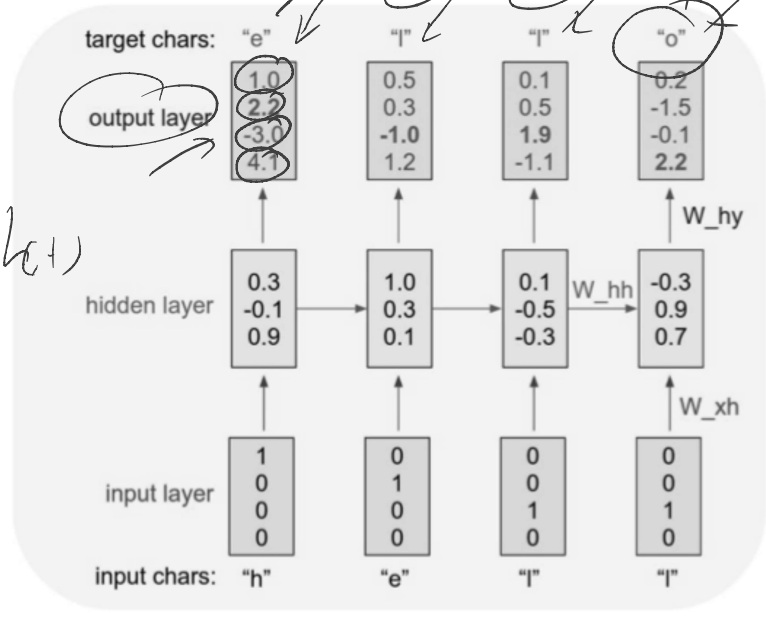


Recurrent Neural Networks

Example: Character-level Language Model

Vocabulary: [h,e,l,o]

Example training sequence: **“hello”**

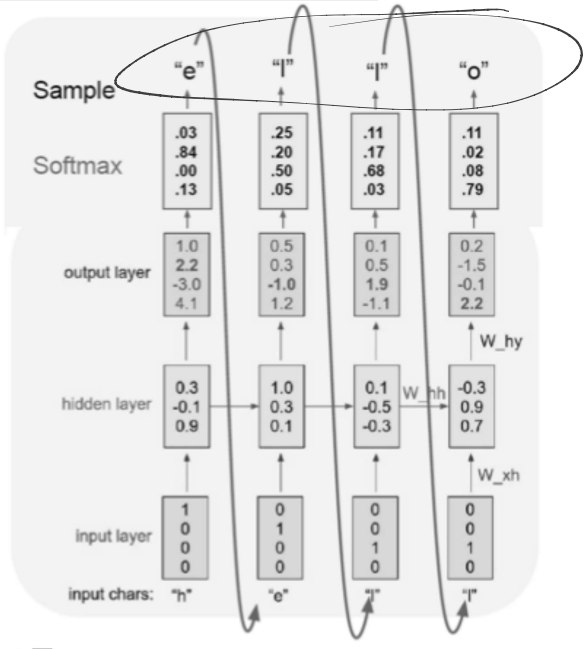


Recurrent Neural Networks

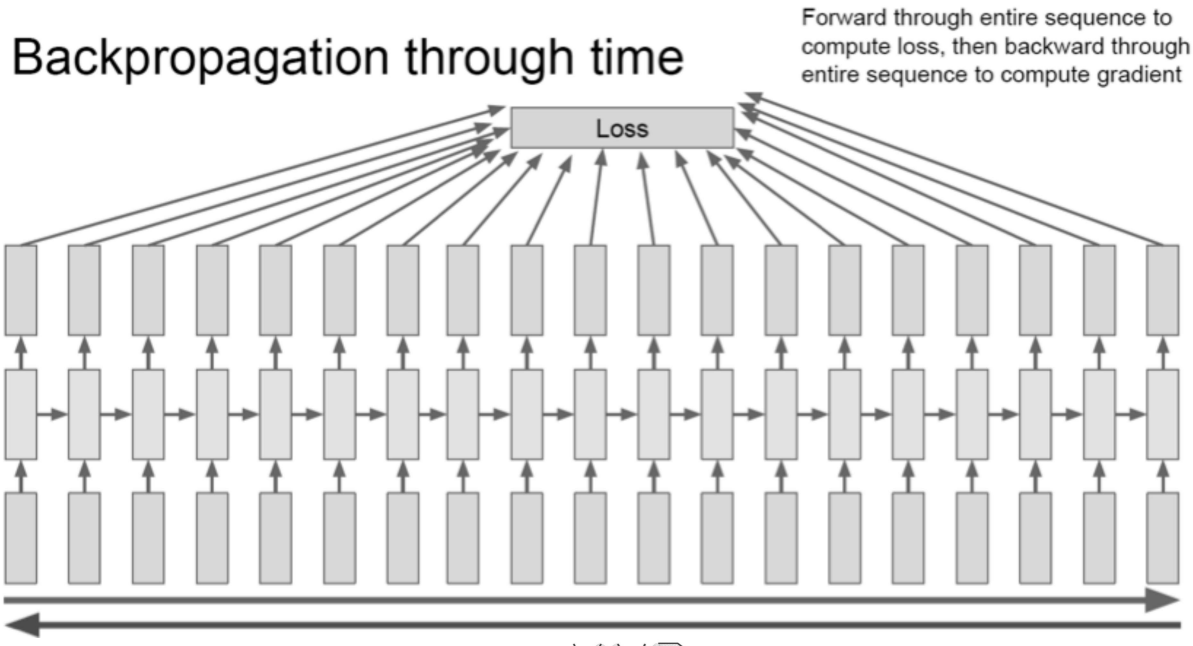
Example: Character-level Language Model Sampling

Vocabulary:
[h,e,l,o]

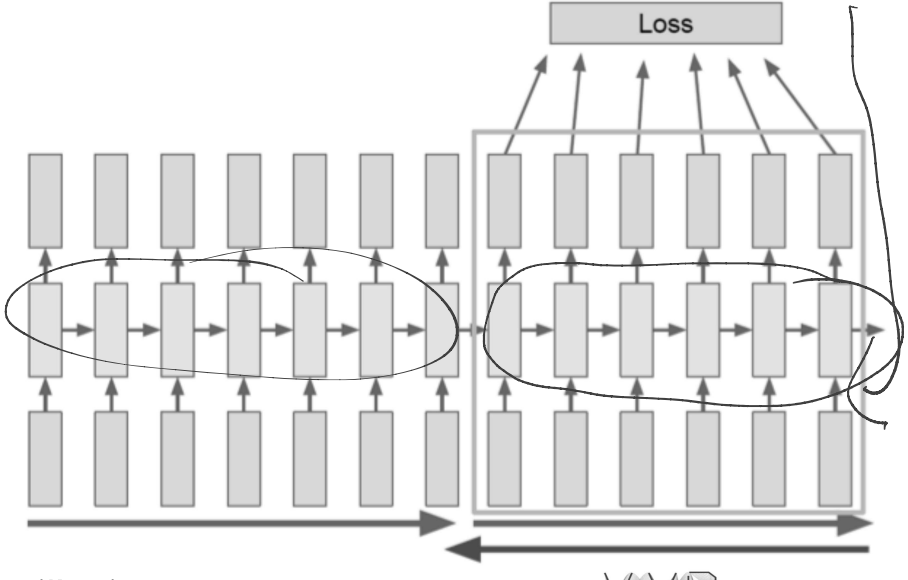
At test-time sample characters one at a time, feed back to model



Recurrent Neural Networks



Truncated Backpropagation through time



Carry hidden states forward in time forever, but only backpropagate for some smaller number of steps

Recurrent Neural Networks

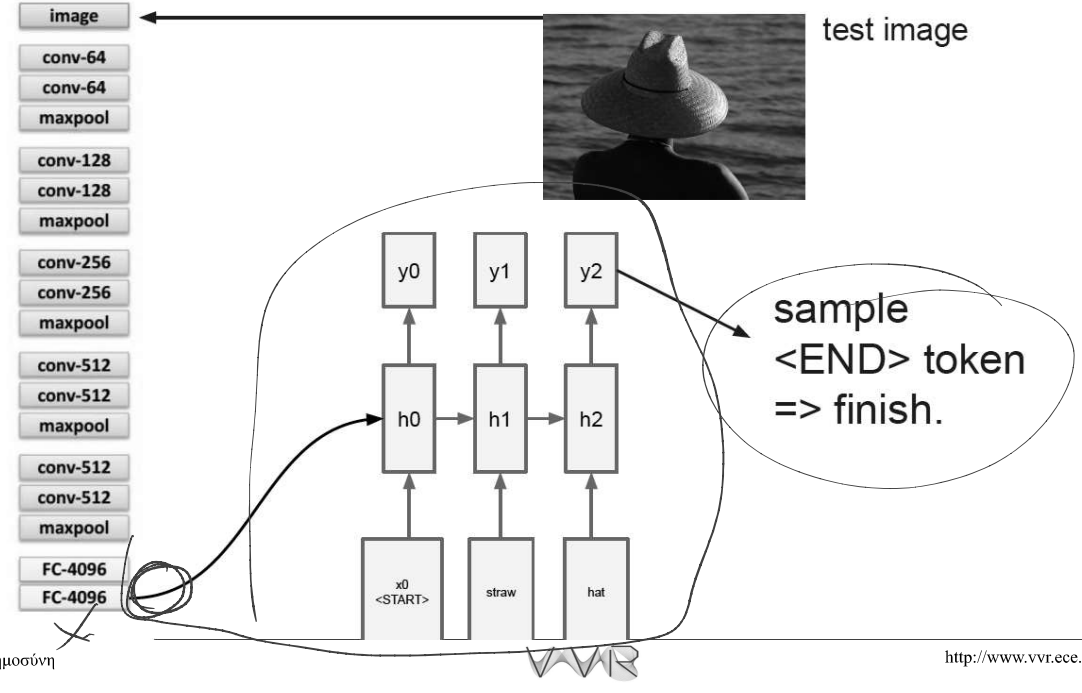
RNN Advantages:

- Can process any length input
- Computation for step *t* can (in theory) use information from many steps back
- Model size doesn't increase for longer input
- Same weights applied on every timestep, so there is symmetry in how inputs are processed.

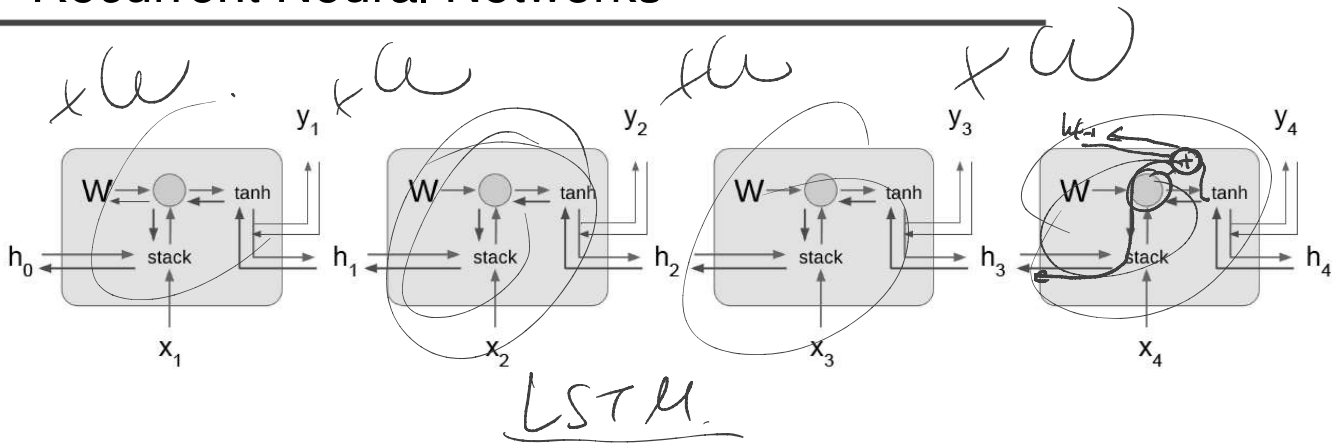
RNN Disadvantages:

- Recurrent computation is slow
- In practice, difficult to access information from many steps back

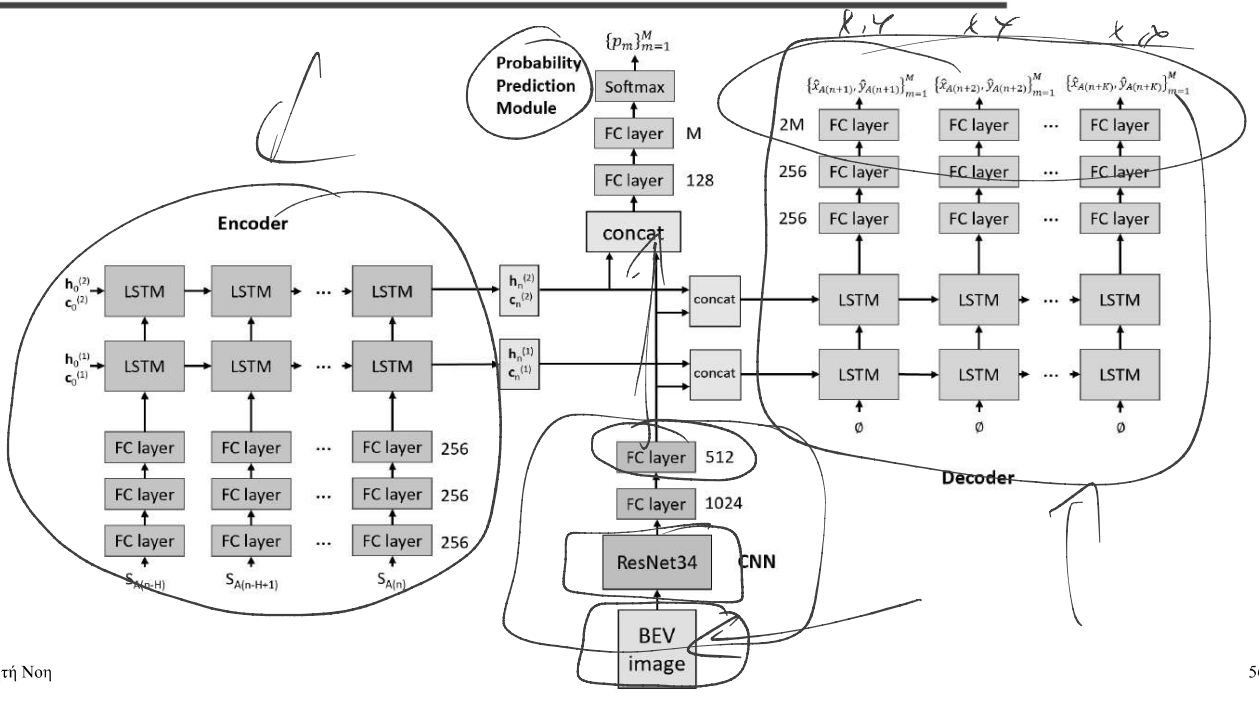
Recurrent Neural Networks



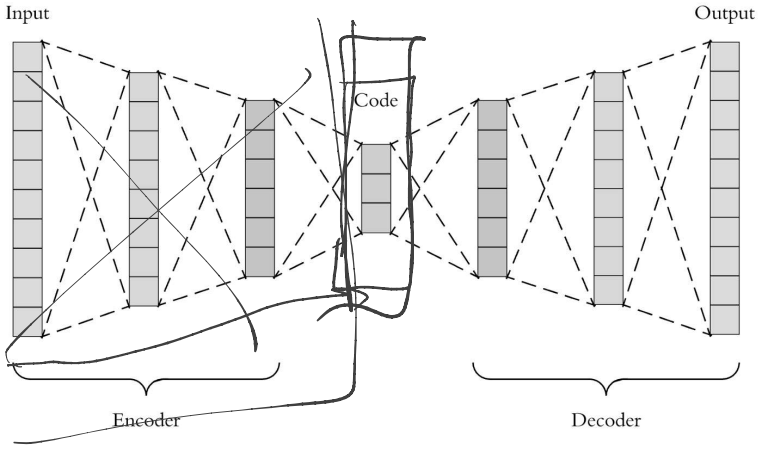
Recurrent Neural Networks



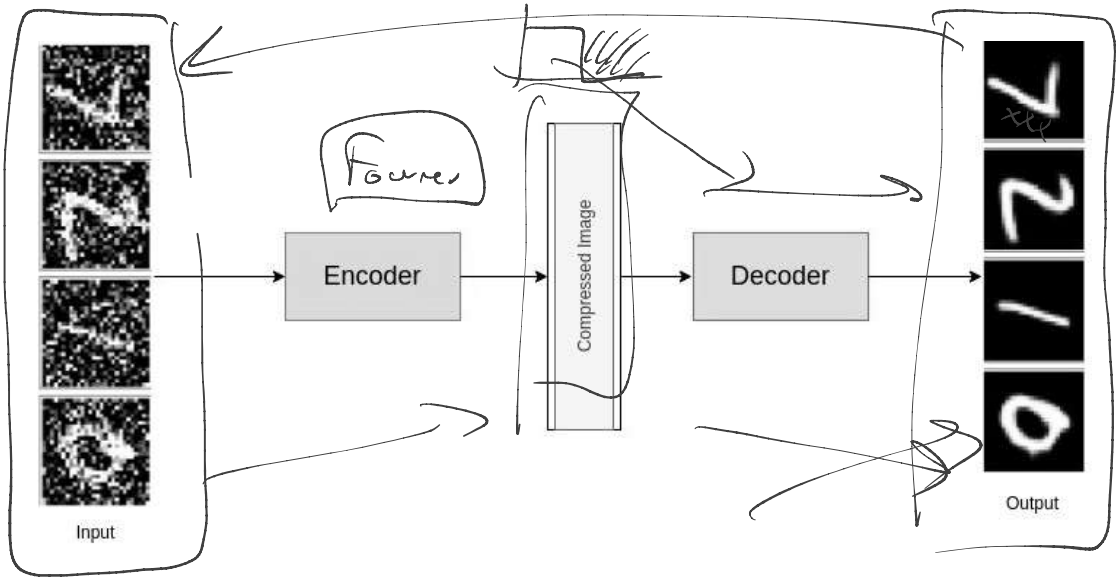
Examples – Motion prediction?



Examples – Autoencoders



Examples – Autoencoders & Denoising



Examples – Autoencoders & Superesolution