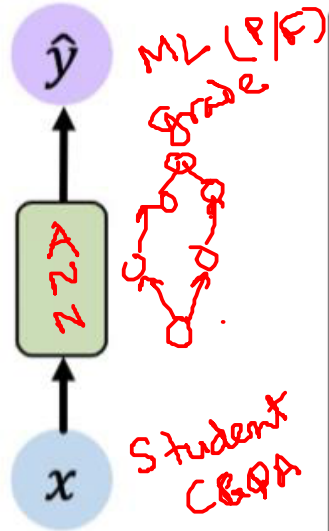
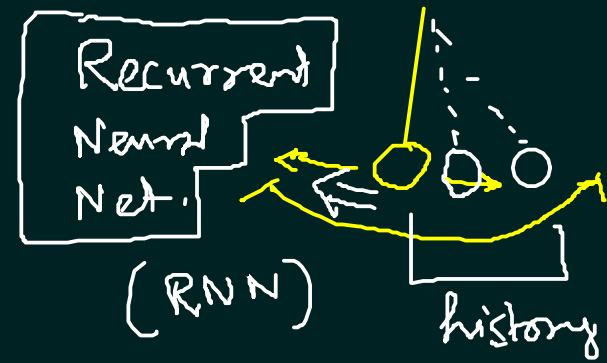
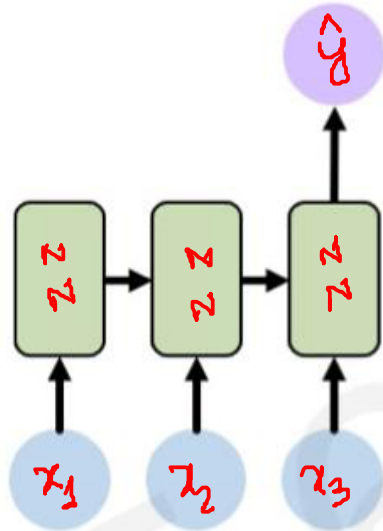


Temporal dependency → Sequence Modeling

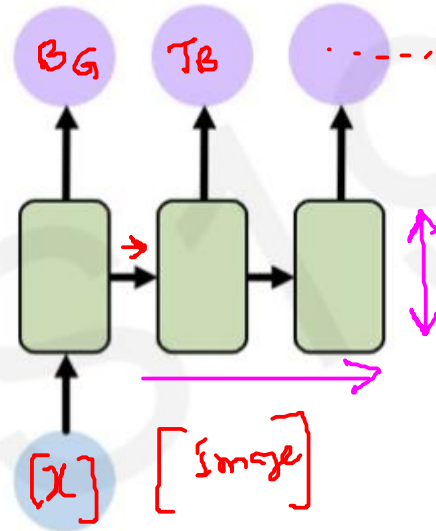
Recurrent Deep



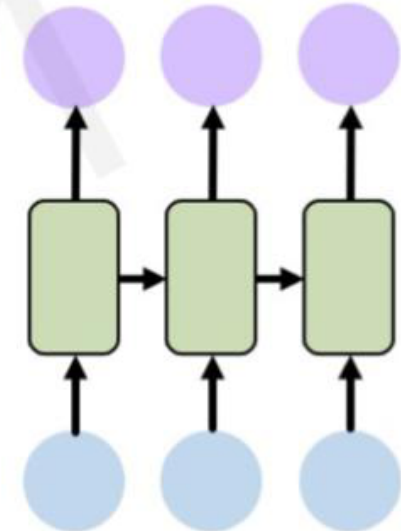
One to One Binary Classification



Many to One Sentiment Classification



One to Many Image Captioning



Many to Many Machine Translation

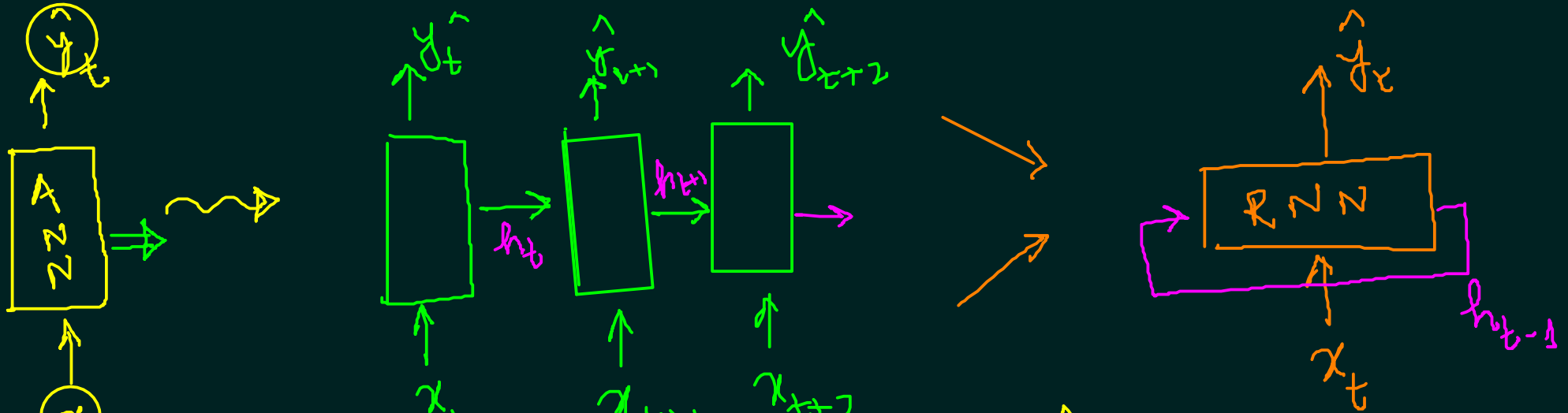
Machine Learning (CS60050) Course will be very helpful and applicable for any student to practice and apply ML to solve real-life problems.



"A baseball player throws a ball."



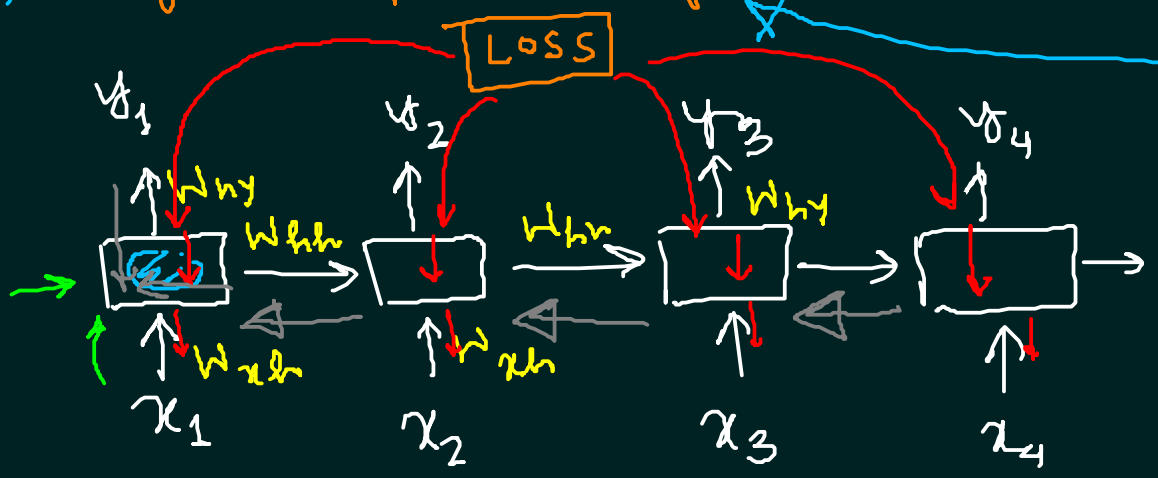
"Will I pass this class?"
Student → Pass?



$$\hat{y}_t = f(x_t, h_{t-1})$$

▷ The clouds are in sky.

▷ I grow up in Bengal, ~~where~~, I speak fluent Bengali.



▷ Update hidden states:

$$h_t = \tanh \left(W_{hh}^T h_{t-1} + W_{xh}^T x_t \right) + \theta$$

▷ Update output state:

$$\hat{y}_t = W_{hy}^T h_t$$

- Backpropagation over time.

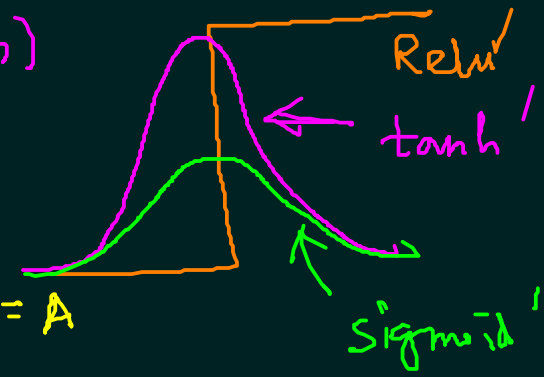
$\theta'(0) = 0(1-0) \rightarrow \theta'(s) = \left(\frac{1}{1+e^{-s}} \right)' = \theta(s)(1-\theta(s))$ ANN : $y \equiv \theta(w, x)$

{ Diminishing Gradient }

→ Activation function (tanh)

→ Initialize parameters

$$A * \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} = A$$



↳ Gated cell

(Long-short term Memory)

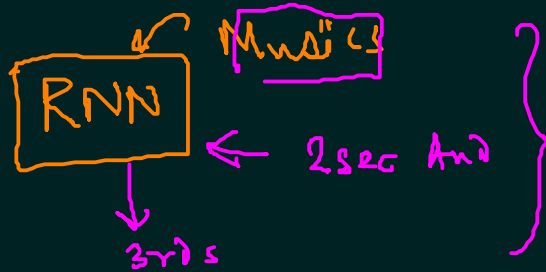
- ① forget
- ② store
- ③ update

Appl.: ① Painting ✗

② Generation Music ✗

RNN

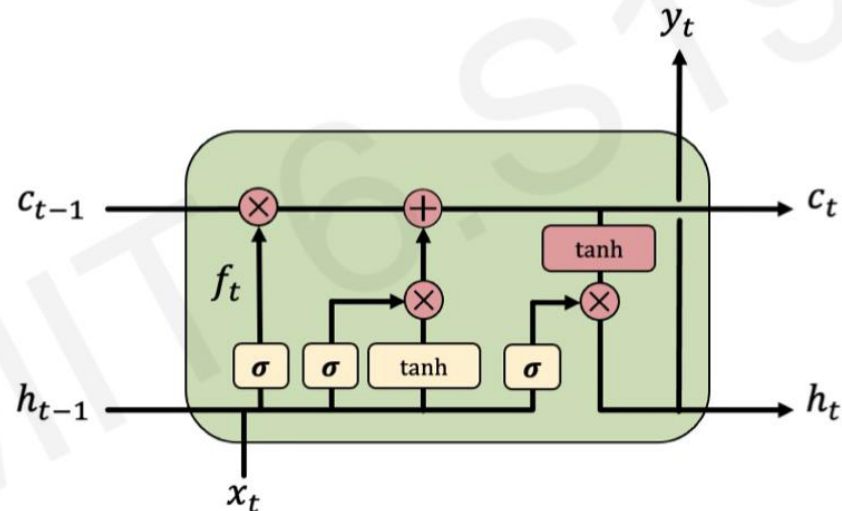
First tone [] [] ...
 3 4 5 ...

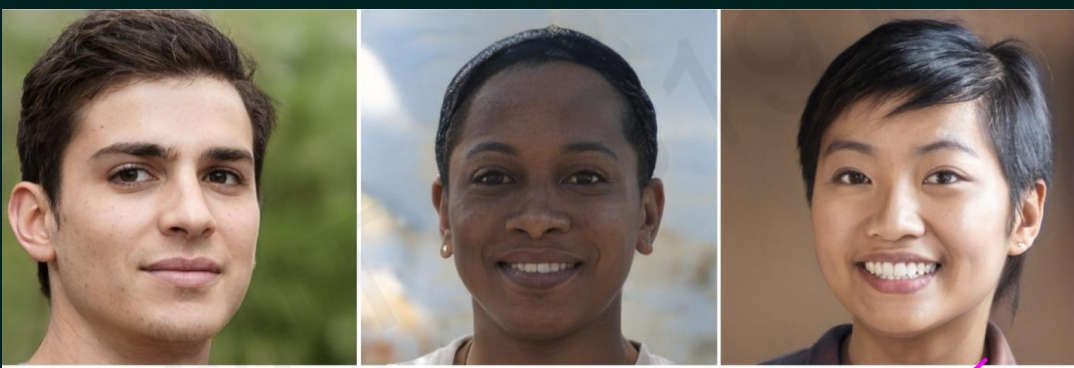


↳ Generative Models

How do LSTMs work?

- 1) Forget
- 2) Store
- 3) Update
- 4) Output





A ✓

B ✓

C ✓

all ↑ Which one is fake? →
Generative Model

A hand-drawn diagram on a dark background. It features a white bell-shaped curve. A red circle is drawn at the left tail of the curve. A red arrow points from this circle towards the right, passing through the curve and ending near the right tail. Another red arrow points from the right tail of the curve towards the right. A red arrow also points from the top of the curve towards the right. The text 'all ↑ Which one is fake? →' is written in yellow above the curve, and 'Generative Model' is written in pink below it.

95% of Driving Data:

(1) sunny, (2) highway, (3) straight road



Detect outliers to avoid unpredictable behavior when training



Edge Cases



Harsh Weather



Pedestrians

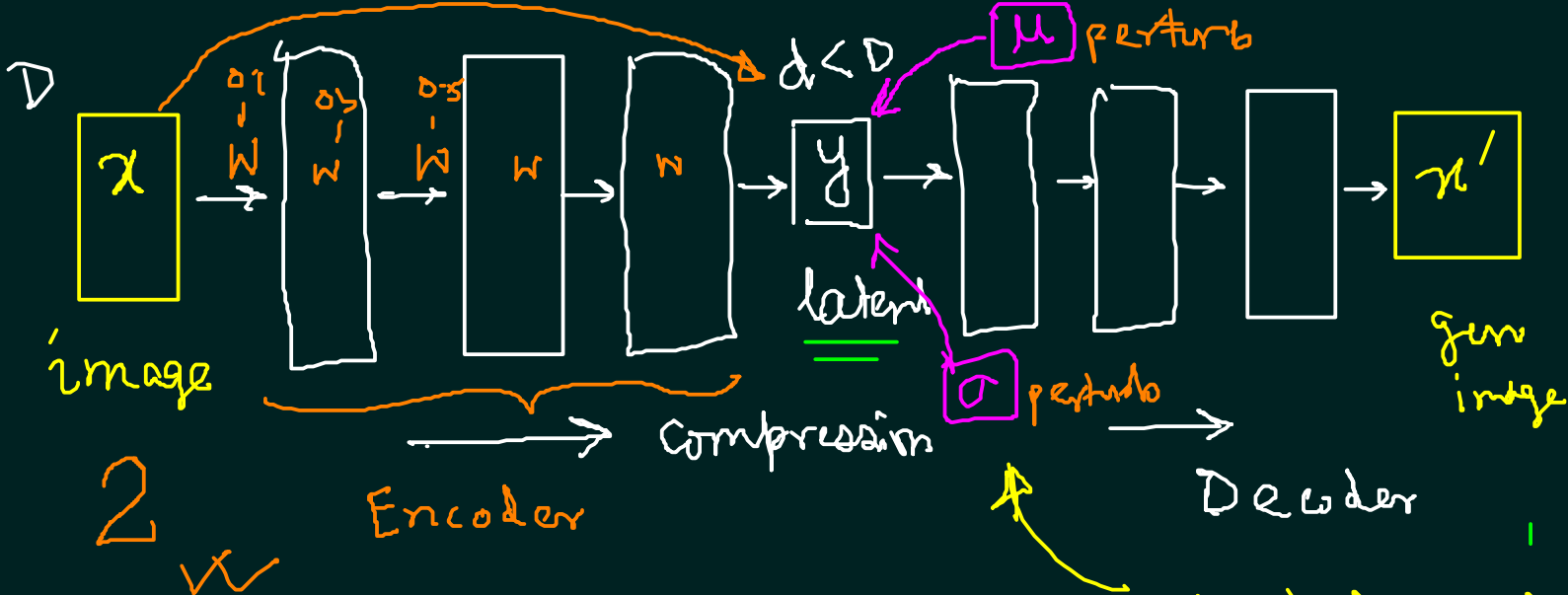


Homogeneous skin color, pose

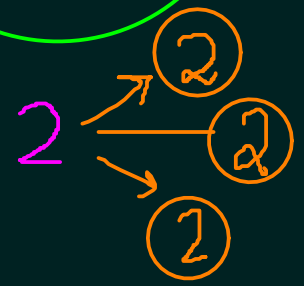
VS



Diverse skin color, pose, illumination



Auto Encoders (AE)



2
w

Encoder

Decoder

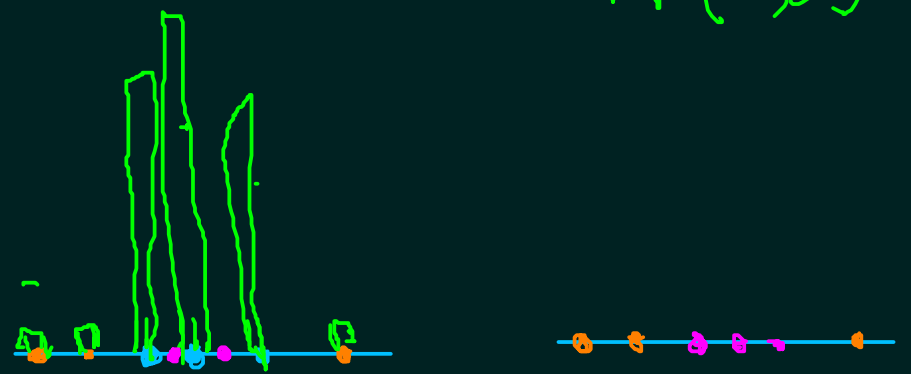
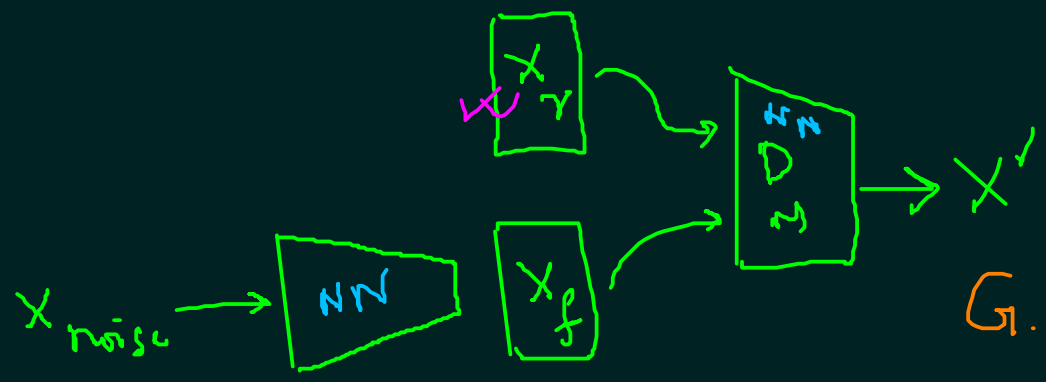
Variation of AE

$$\mathcal{L}(x, x') = \frac{1}{2} \|x - x'\|^2 \quad \text{(VAE)}$$

$\mathcal{N}(\mu, \sigma)$

II

(Discriminative Model)



G. Adversarial Net (GAN)

Smile



Head pose

