Recurrent Neural Networks (RNN)

Intuition

Previous frames

Current frame

Sequence Modeling Problem

Next word prediction

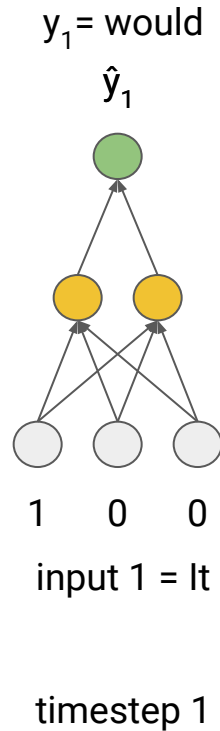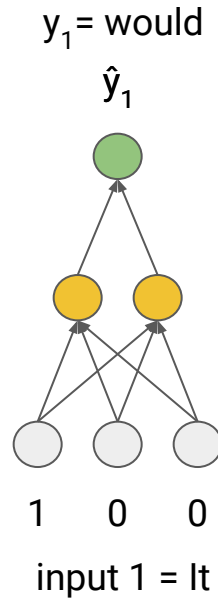Enter the beginning of a phrase:

It would mean the
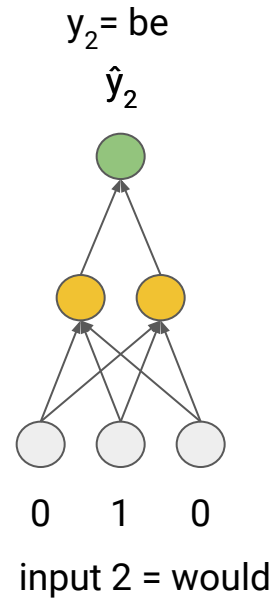
Top-3 predictions:

world   same   most

Analytics Vidhya
Learn everything about analytics

RNN Architecture

y_1 = would

$\hat{y}_1$

1   0   0

input 1 = It

timestep 1

RNN Architecture

RNN Architecture

y_1 = would

$\hat{y}_1$

y_2 = be

$\hat{y}_2$

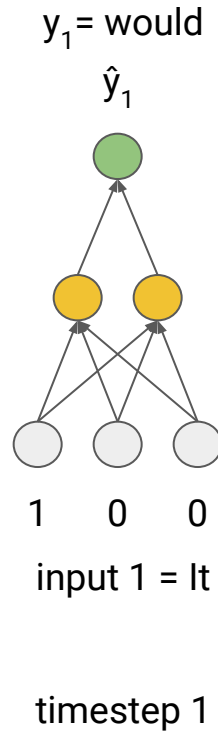...   ...

1   0   0

input 1 = It

0   1   0

input 2 = would
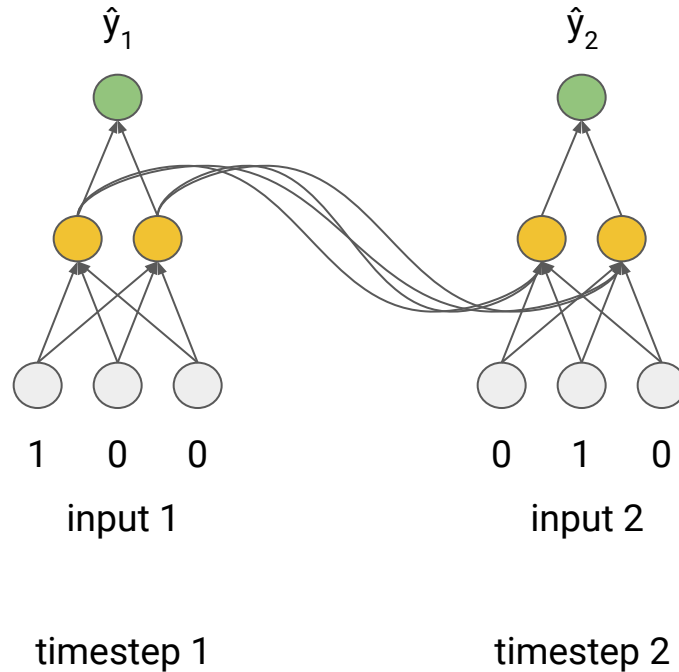
timestep 1
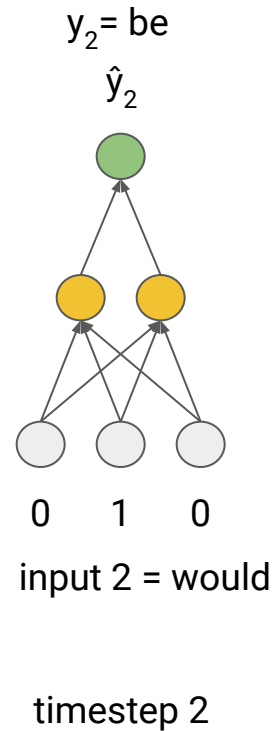
timestep 2

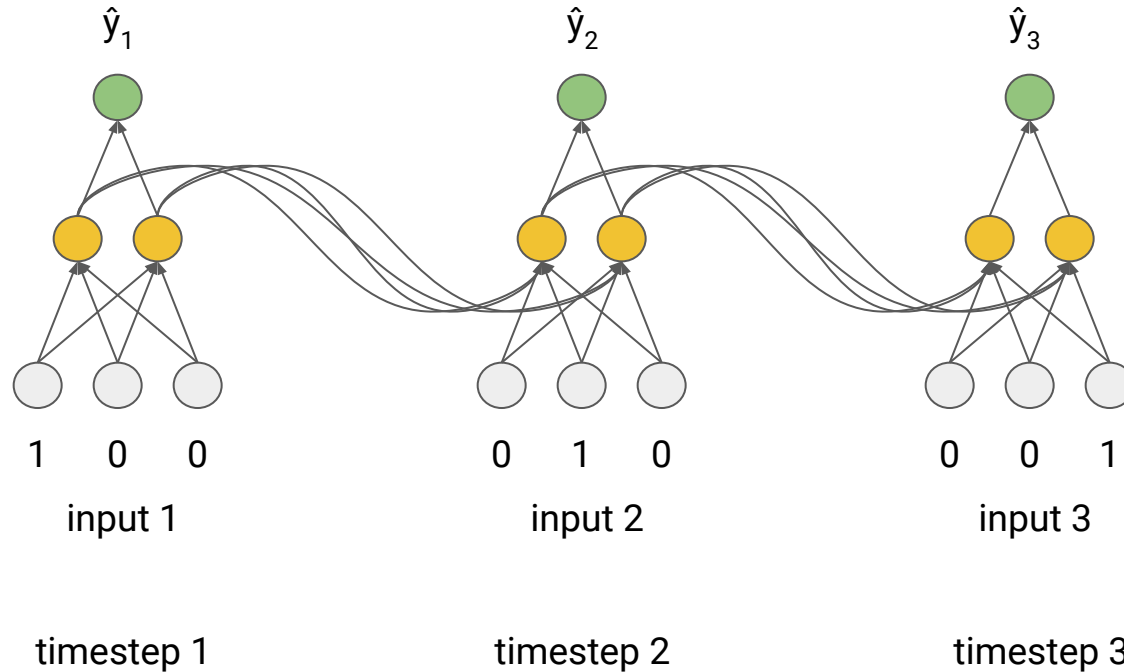# Intuition
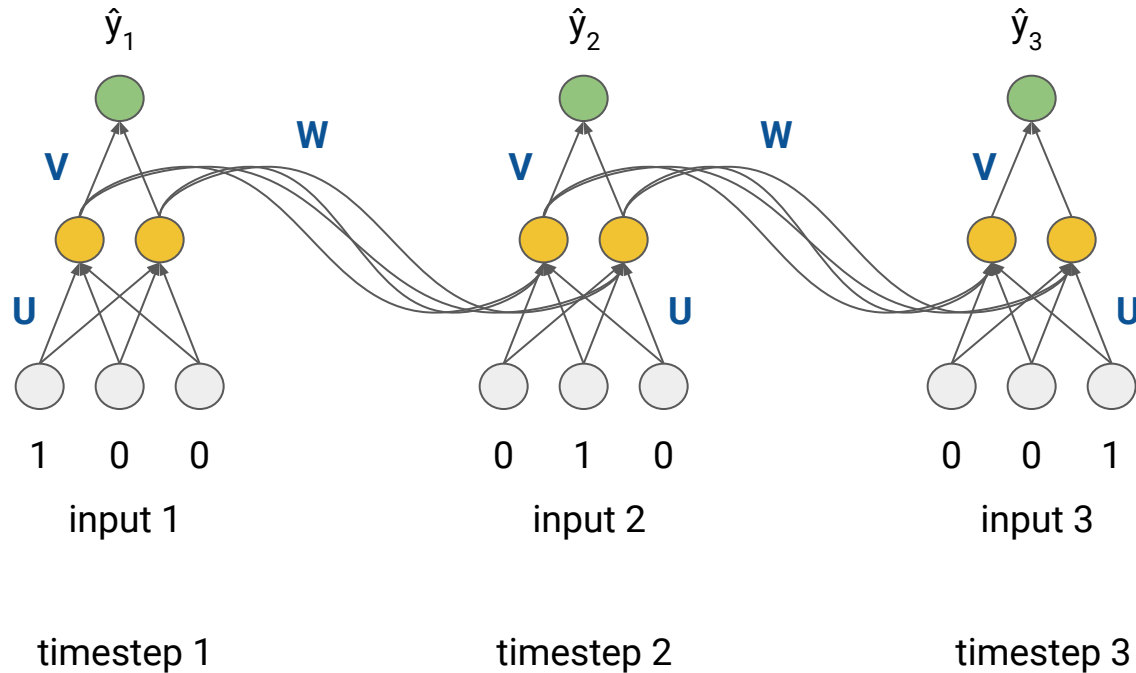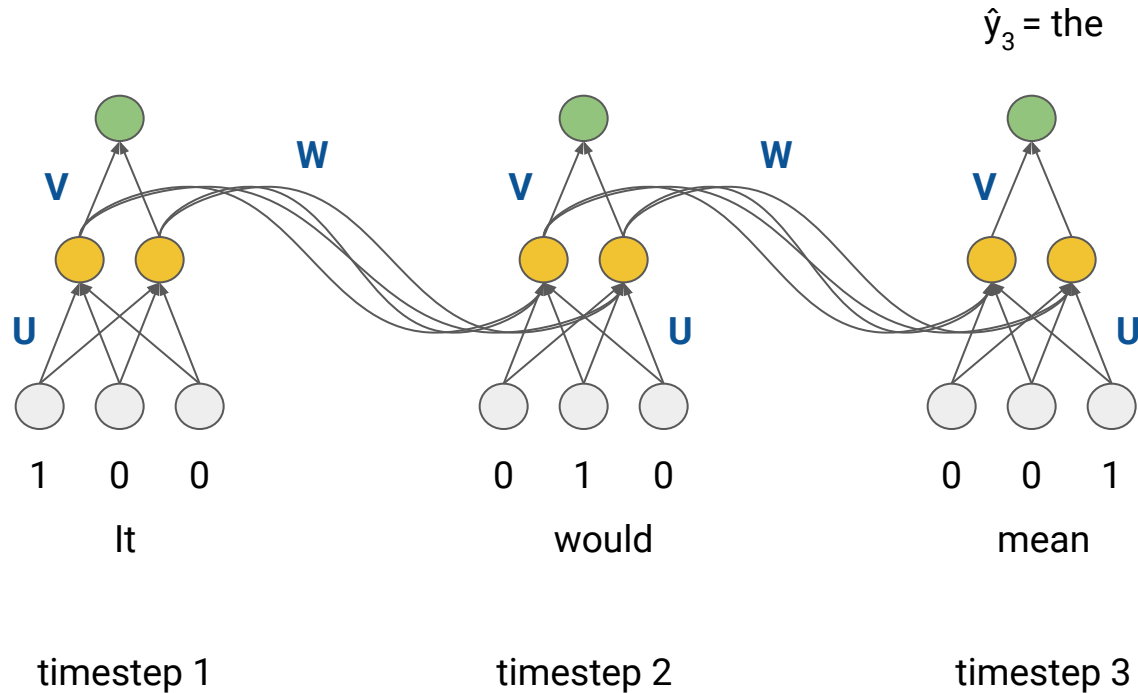

Previous frames

Current frame

RNN Architecture
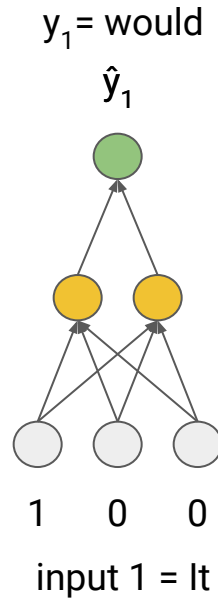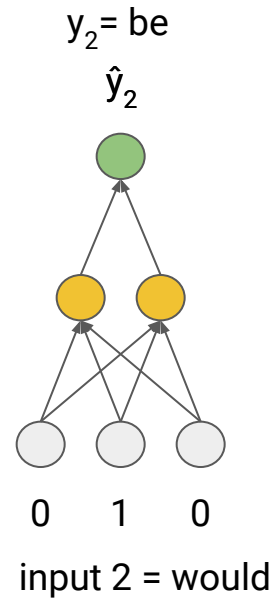
RNN Architecture

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RNN Architecture
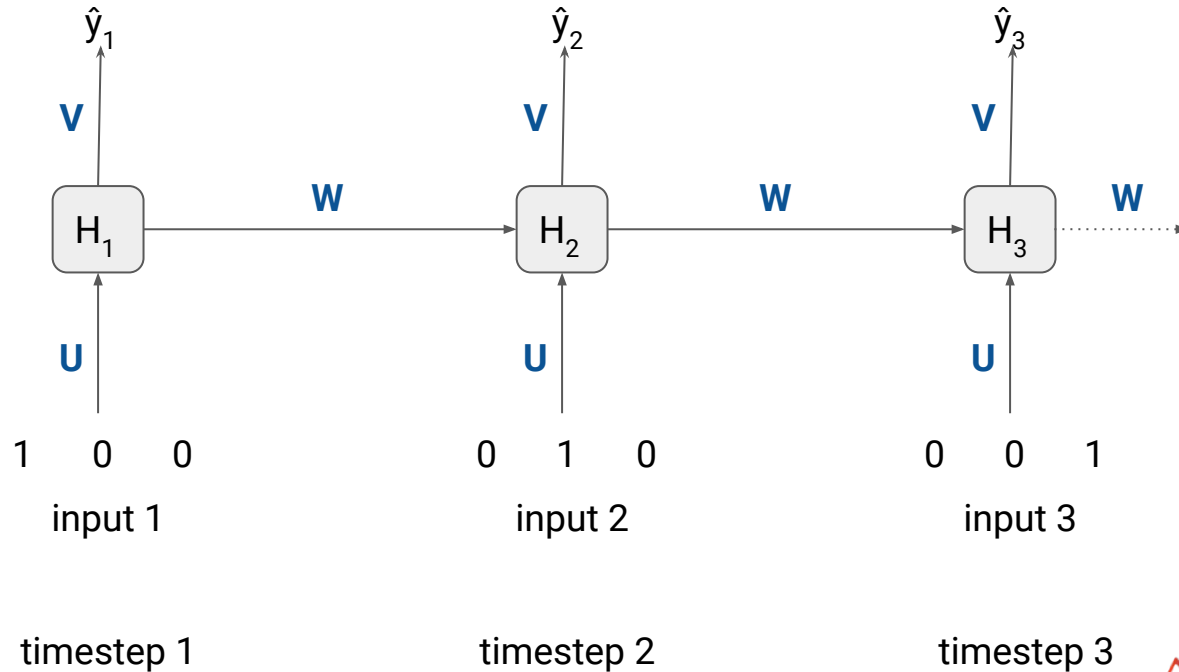
RNN Architecture
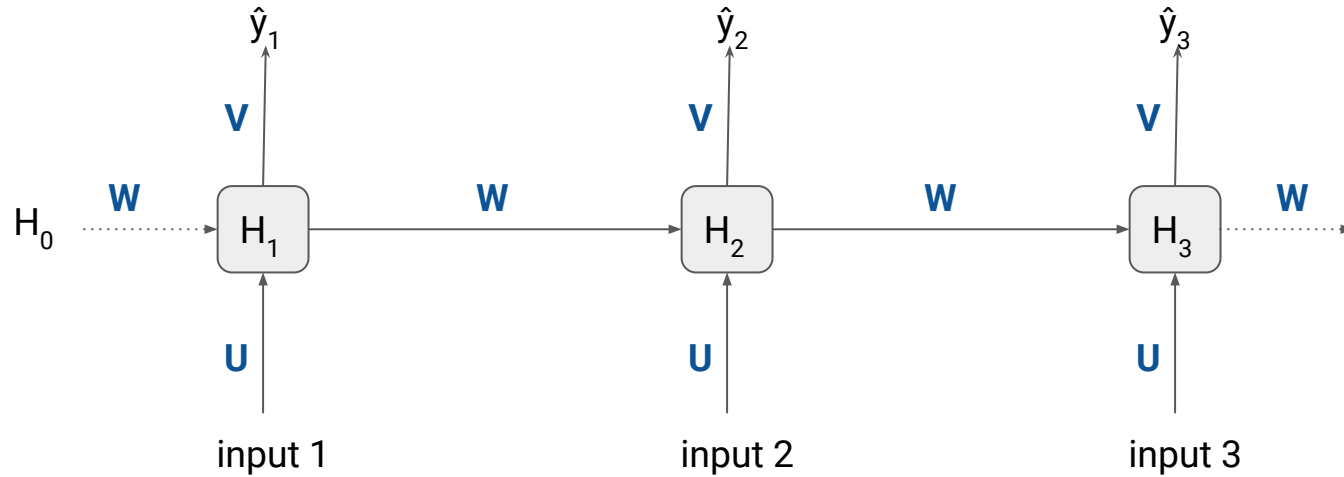
RNN Architecture

RNN Architecture
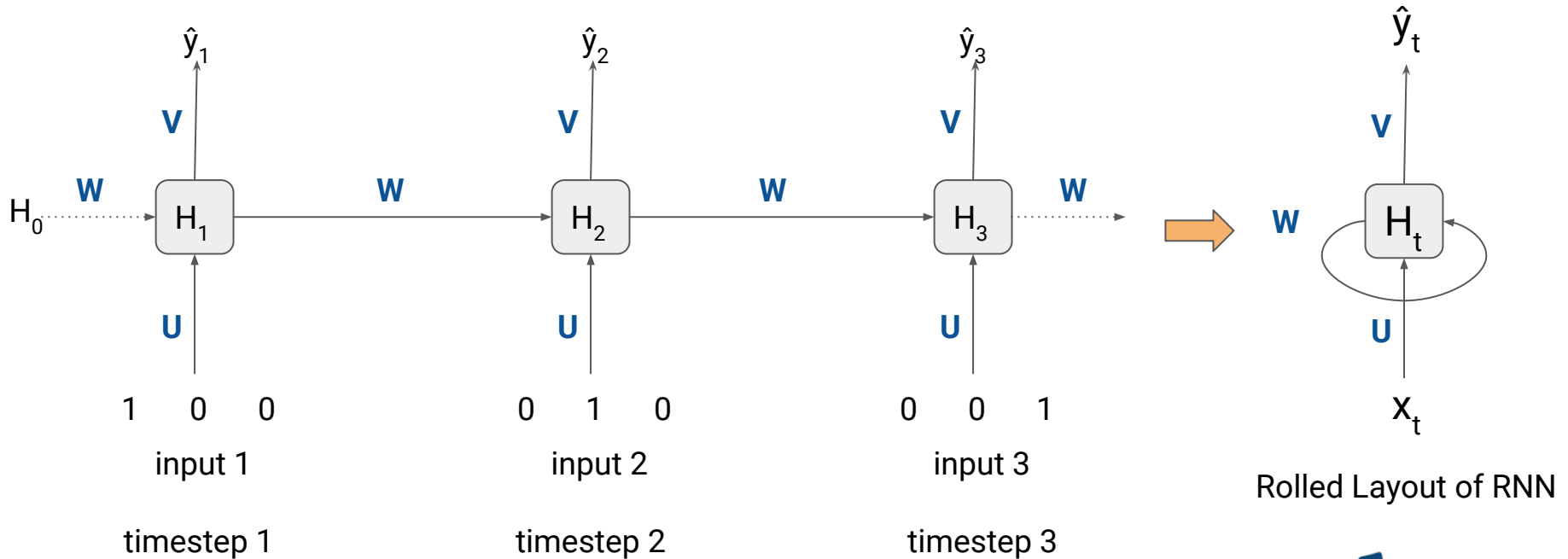

Rolled Layout of RNN
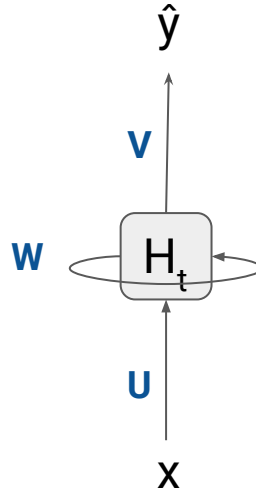
RNN Architecture

Rolled Layout of RNN

RNN Architecture Variants
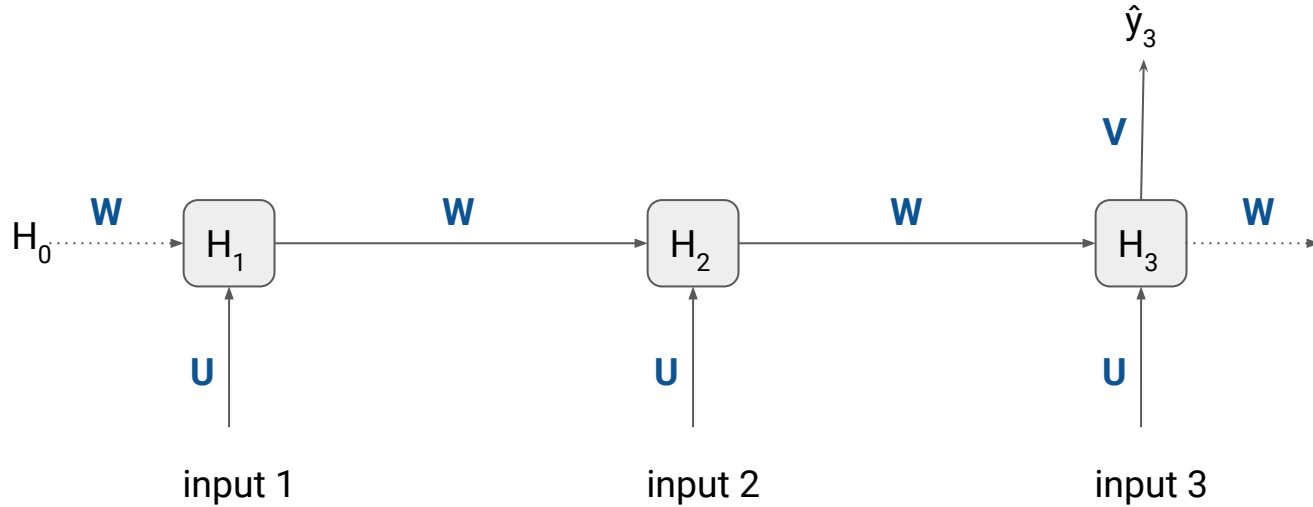
many-to-one

RNN Architecture Variants

many-to-many

RNN Architecture Variants
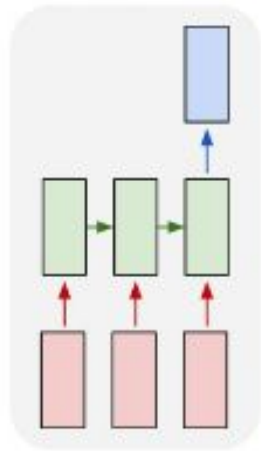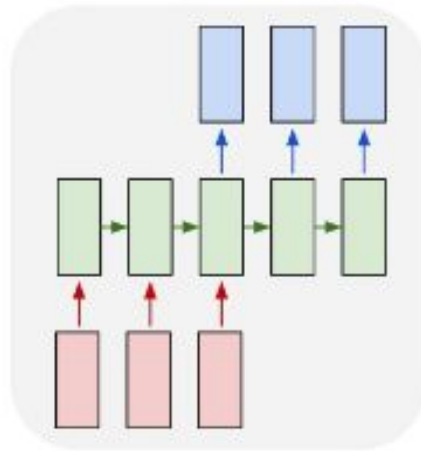
many-to-one   many-to-many
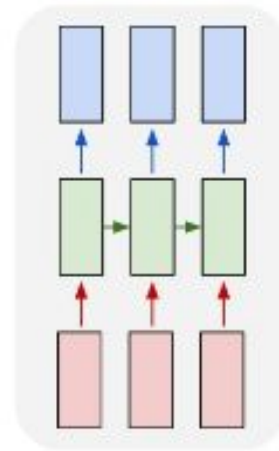
Functioning of RNN

Task: Classify sentiment of the text as positive or negative

Functioning of RNN - Forward Propagation

Task: Classify sentiment of the text as positive or negative

- Input sentence: "they are happy"

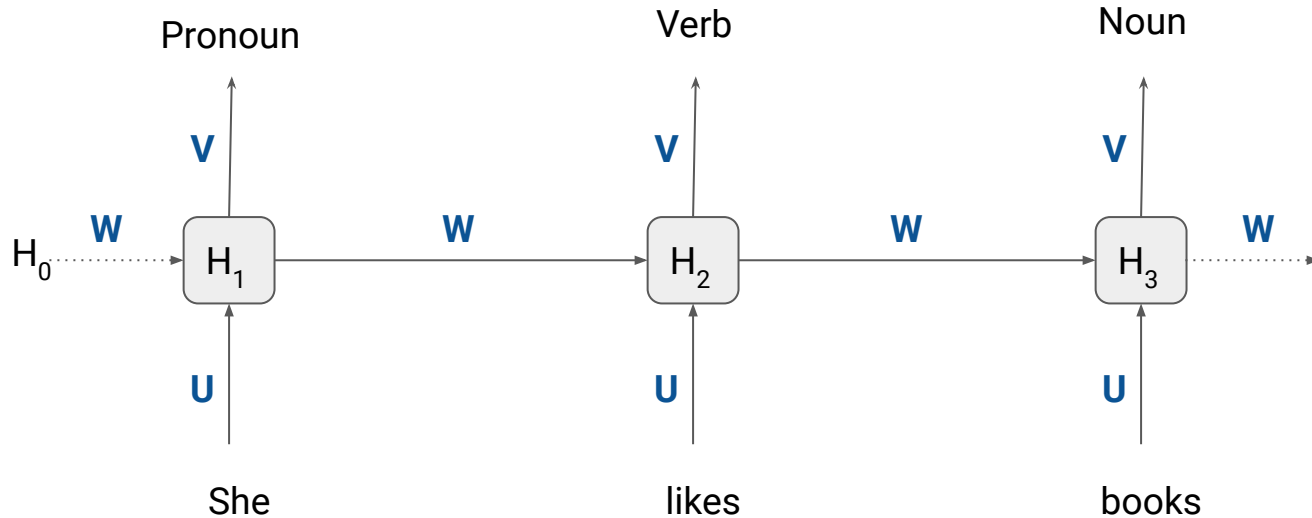# Functioning of RNN - Forward Propagation

Task: Classify sentiment of the text as positive or negative

- Input sentence: "they are happy"

- First token, 'they', will be passed as input at timestep 1

H_0 $\xrightarrow{\quad W \quad}$ H_1

U

X_1
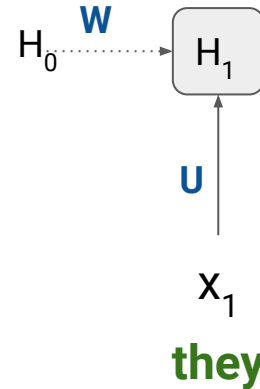
they

Functioning of RNN - Forward Propagation

Task: Classify sentiment of the text as positive or negative

- Input sentence: "they are happy"

- First token, 'they', will be passed as input at timestep 1

- Second token, 'are', will be passed at timestep 2 and so on

Functioning of RNN - Forward Propagation

Task: Classify sentiment of the text as positive or negative
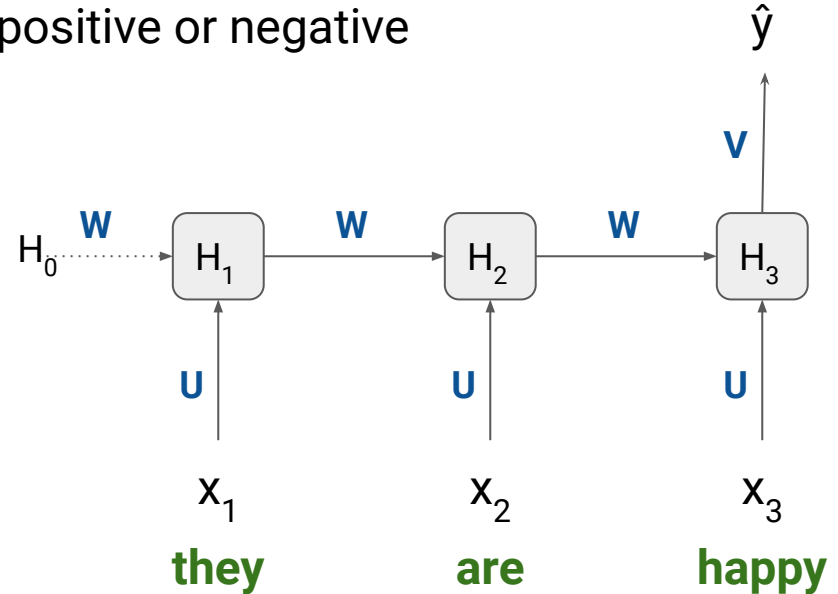
- Input sentence: "they are happy"

- First token, 'they', will be passed as input at timestep 1

- Second token, 'are', will be passed at timestep 2 and so on
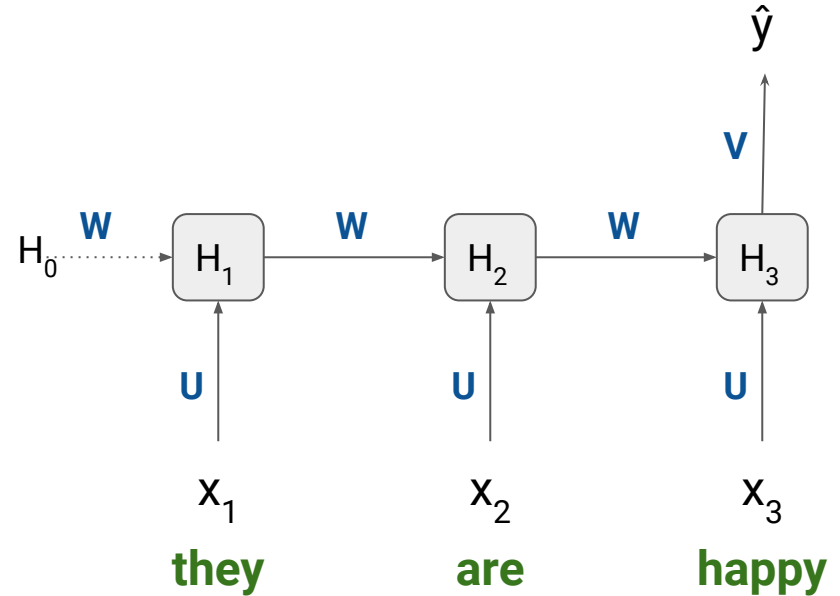
- Output obtained at last timestep.

$\hat{y}$

V

$H_0 \xrightarrow{W} \boxed{H_1} \xrightarrow{W} \boxed{H_2} \xrightarrow{W} \boxed{H_3}$

$U \qquad\qquad U \qquad\qquad U$

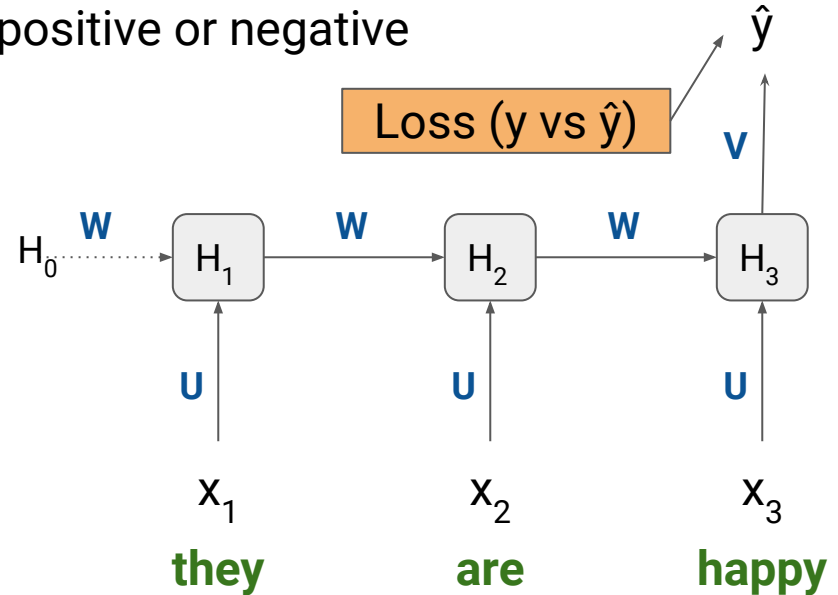$x_1 \qquad\qquad x_2 \qquad\qquad x_3$

they **are** **happy**

Functioning of RNN - Back Propagation

Functioning of RNN - Back Propagation

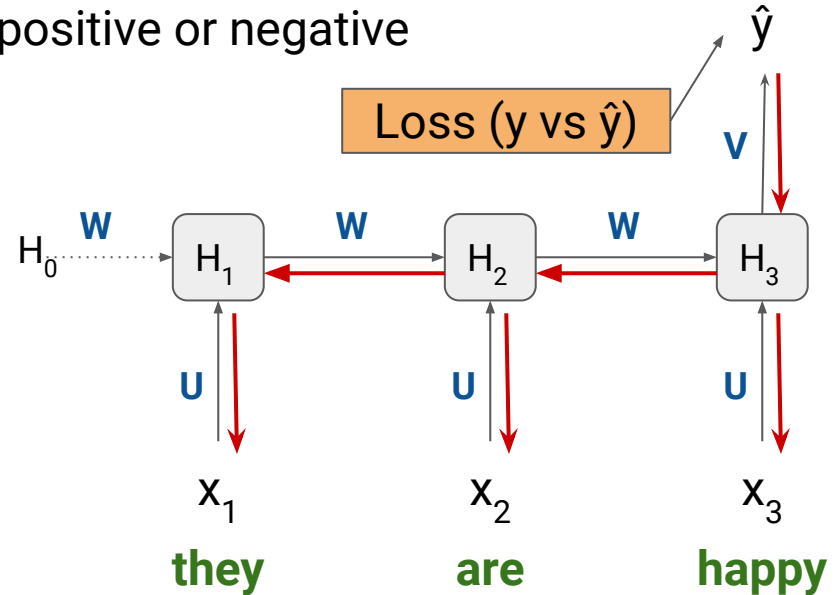**Task:** Classify sentiment of the text as positive or negative

- Loss (L) is calculated at the final timestep

Functioning of RNN - Back Propagation

Task: Classify sentiment of the text as positive or negative

- Loss (L) is calculated at the final timestep

- $\partial L/\partial V$, $\partial L/\partial W$ and $\partial L/\partial U$ are computed

Functioning of RNN - Back Propagation

Task: Classify sentiment of the text as positive or negative
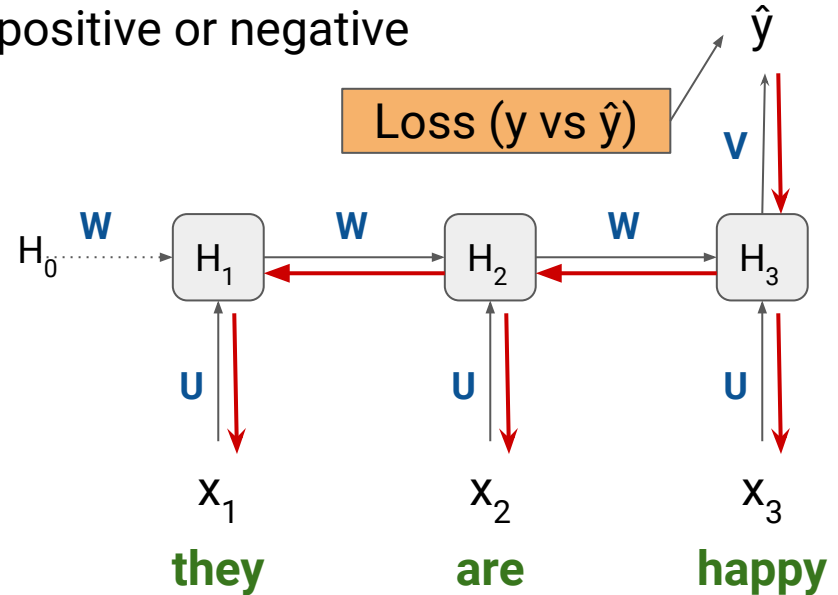
- Loss (L) is calculated at the final timestep

- $\partial L/\partial V$, $\partial L/\partial W$ and $\partial L/\partial U$ are computed

- Weight matrices W, U, and V are updated

Thank You