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TODAY

HMMs parameter matrix calculation

01:46 AM

How can one compute the emission and transition matrices for a Hidden Markov Model (HMM) based on a 3-character sequence

THIS WEEK

What percentage of the grade are the l...

Monday

What will be the weight of the laboratory assignments on the total score?

What is the bias variance tradeoff?

Monday

Can someone please explain the bias-variance tradeoff to me?

What are graphical models?

Monday

Can someone please give me a brief explanation of graphical models?

What is the penalty for a late submissi...

Sunday

I submitted an assignment one day late. What would be the penalty that I would incur on this assignment?

What are Bayesian Networks?

Sunday

Can anyone please give a brief description of Bayesian Networks to me?

LAST WEEK

Difference between ridge regression a...

Monday

Can someone please explain the difference between ridge and lasso regression?

WEEK 4/7 - 4/13

What is linear regression?

4/13/24

I have read the slides and kind of understand the concepts, but can someone help with the implementation hints using Num

1 Unresolved followup

Welcome to Piazza!

4/8/24

Piazza is a Q&A platform designed to get you great answers from classmates and instructors fast. We've put together

question @25

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1 view

HMMs parameter matrix calculation

How can one compute the emission and transition matrices for a Hidden Markov Model (HMM) based on a 3-character sequence? Additionally, could you provide the relevant formulas for these calculations?

exam

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Updated 1 second ago by Grace Altree

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&  
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## HMMs parameter matrix calculation

How can one compute the emission and transition matrices for a Hidden Markov Model (HMM) based on a 3-character sequence? Additionally, could you provide the relevant formulas for these calculations?



Question Subject  
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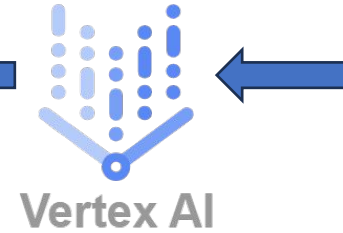
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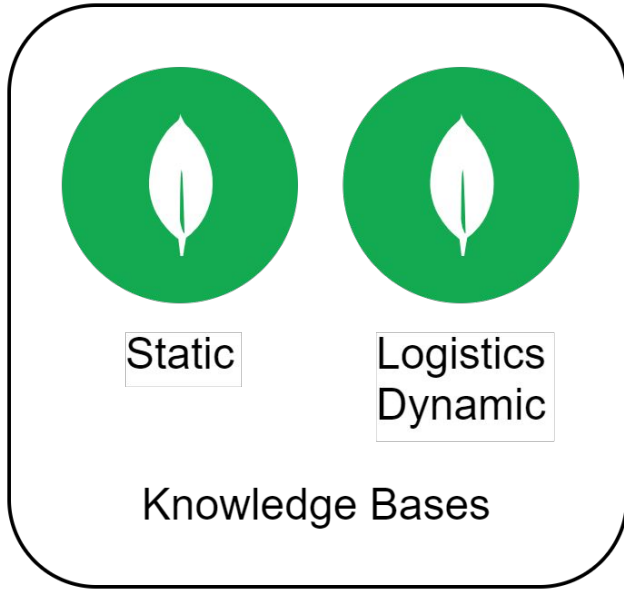


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## HMMs parameter matrix calculation

How can one compute the emission and transition matrices for a Hidden Markov Model (HMM) based on a 3-character sequence? Additionally, could you provide the relevant formulas for these calculations?



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# Homogenous HMM

- We include an additional assumption

$$P(S_j = s_j | S_{j-1} = s_{j-1}) = t(s_j | s_{j-1})$$

$$P(X_j = x_j | S_j = s_j) = e(x_j | s_j)$$

- the transition and emission probabilities do not depend on the position in the Markov chain (do not depend on the index  $j$ )

$$p(x_1 \dots x_m, s_1 \dots s_m) = t(s_1) \prod_{j=2}^m t(s_j | s_{j-1}) \prod_{j=1}^m e(x_j | s_j)$$

- Initial state parameters  $t(s)$  for  $s \in \{1, 2, \dots, k\}$
- Transition parameters  $t(s' | s)$  for  $s, s' \in \{1, 2, \dots, k\}$

# HMM Learning

- We collect a fully observed dataset  $\{X_i, S_i\}_{i=1}^N$

## Training set:

1 Pierre/NNP Vinken/NNP ./, 61/CD years/NNS old/JJ ./, join/VB the/DT board/NN as/IN a/DT nonexecutive/JJ director/NN Nov./NNP 29/CD ./.

2 Mr./NNP Vinken/NNP is/VBZ chairman/NN of/IN Elsevier/N.V./NNP ./, the/DT Dutch/NNP publishing/VBG group/NNP  
3 Rudolph/NNP Agnew/NNP ./, 55/CD years/NNS old/JJ chairman/NN of/IN Consolidated/NNP Gold/NNP Fields/NNP ./, was/VBD named/VBN a/DT nonexecutive/JJ director/NN this/DT British/JJ industrial/JJ conglomerate/NN ./.

...  
38,219 It/PRP is/VBZ also/RB pulling/VBG 20/CD people of/IN Puerto/NNP Rico/NNP ./, who/WP were/VBD help Hurricane/NNP Hugo/NNP victims/NNS ./, and/CC sending them/PRP to/TO San/NNP Francisco/NNP instead/RB ./.

## Maximum Likelihood Estimate:

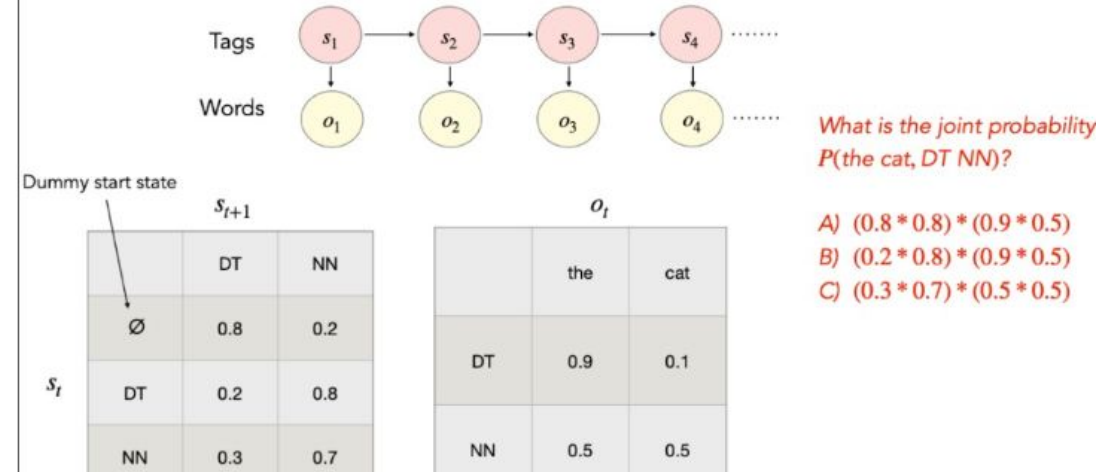
$$\max_{t(\cdot|\cdot), e(\cdot|\cdot)} \prod_{i=1}^N P(X_i, S_i)$$

$$t(s' | s) = \frac{\text{count}(s \rightarrow s')}{\text{count}(s)}$$

$$e(x | s) = \frac{\text{count}(s \rightarrow x)}{\text{count}(s)}$$

# HMM Example

## Sequence probability



# HMM Learning Example

1. the/DT cat/NN sat/VBD on/IN the/DT mat/NN

2. Princeton/NNP is/VBZ in/IN New/NNP Jersey/NNP

3. the/DT old/NN man/VB the/DT boats/NNS

$$t(\text{NN} | \text{DT}) = \frac{3}{4}$$

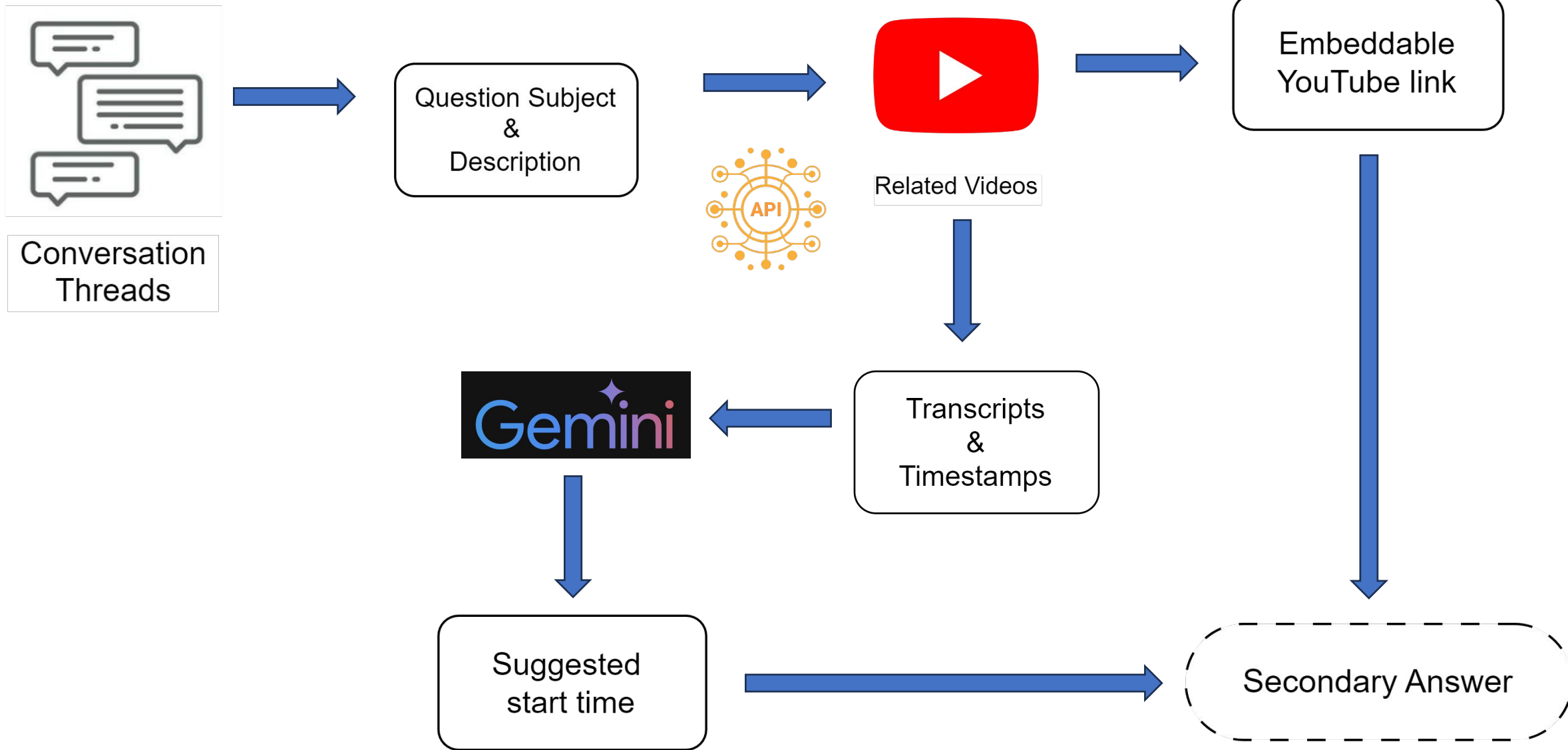
$$e(\text{cat} | \text{NN}) = \frac{1}{3}$$

## Maximum Likelihood Estimate:

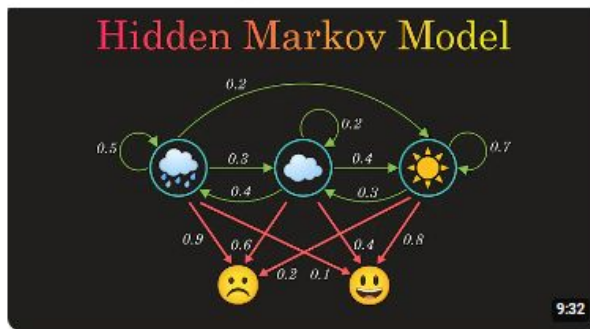
$$\max_{t(\cdot|\cdot), e(\cdot|\cdot)} \prod_{i=1}^N P(X_i, S_i)$$

$$t(s' | s) = \frac{\text{count}(s \rightarrow s')}{\text{count}(s)}$$

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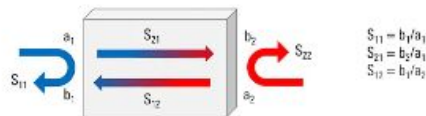






## Example – Two port network

► In a two port network there are four S-parameters:  $S_{11}$ ,  $S_{21}$ ,  $S_{12}$ , and  $S_{22}$ .



## Hidden Markov Model Clearly Explained! Part - 5

404K views • 3 years ago



Normalized Nerd

So far we have discussed Markov Chains. Let's move one step further. Here, I'll explain the Hidden Markov Model with an easy ...

## Understanding S Parameters

193K views • 4 years ago



Rohde Schwarz

Radio frequency networks are characterized using S (scattering) parameters, and this video provides an easy introduction to S ...

CC



Understanding S-parameters | What is a network? | Analyzing networks | What are S-parameters? | ...

8 chapters ▾

5 Understanding S-parameters ROHDE SCHWARZ 5:16

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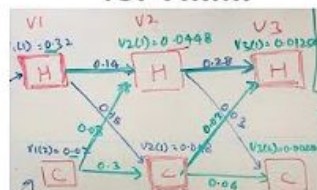
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## Viterbi Algorithm for HMM



## Viterbi Algorithm | HMM | Solved Decoding Example

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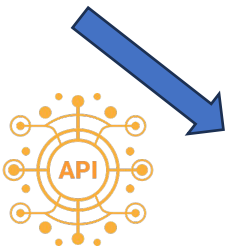
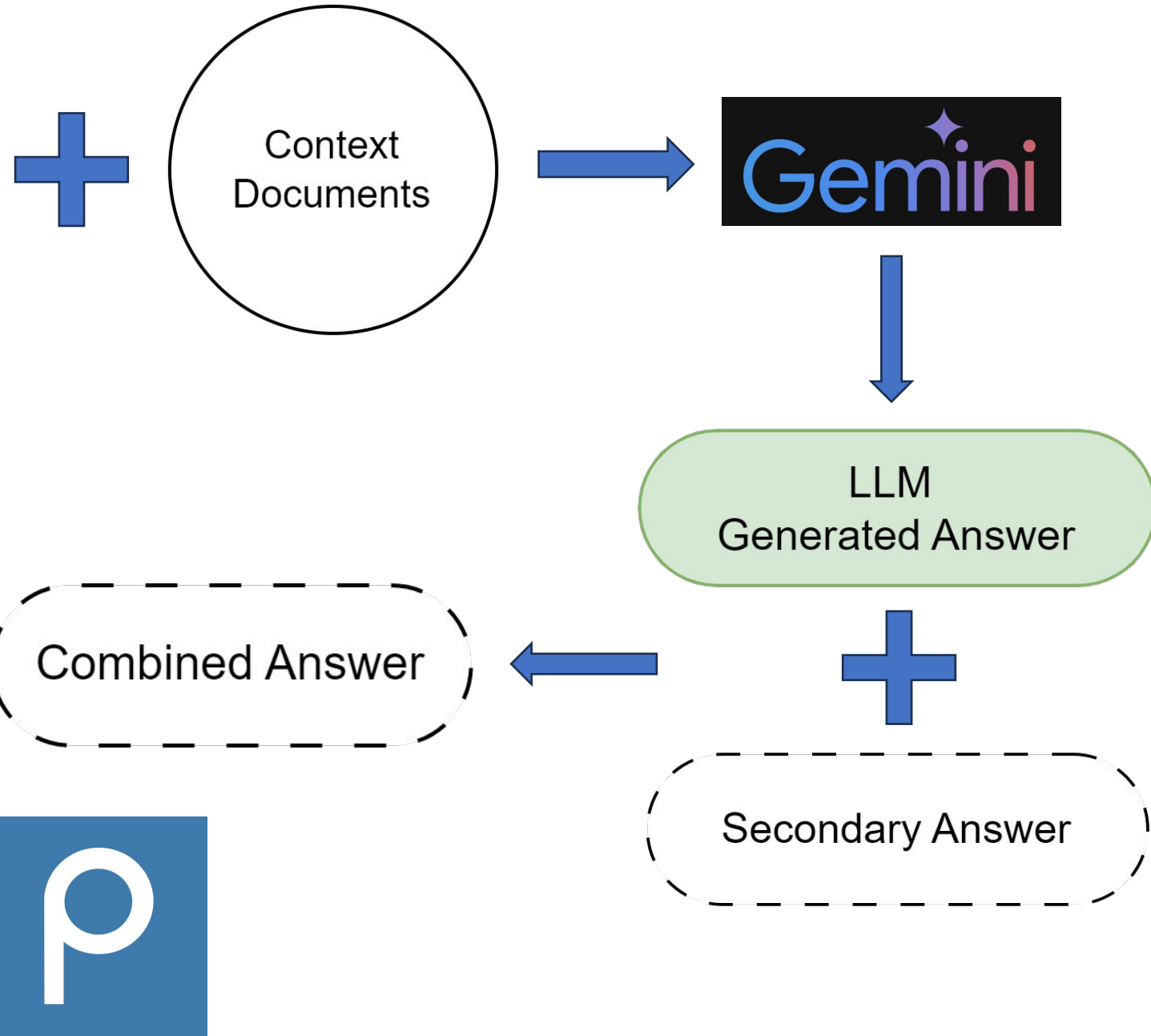


Binod Suman Academy

How to solve Hidden Markov Model Decoding problem. Markov Model Introduction: <https://youtu.be/onSi24IM47U> Markov Model ...

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- Transition parameters  $t(s'|s)$  for  $s, s' \in \{1, 2, \dots, k\}$
- Emission parameters  $e(x|s)$  for  $s \in \{1, 2, \dots, k\}$  and  $x \in \{1, 2, \dots, o\}$

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Hidden Markov Model Clearly Explained | Part - 5

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01:48 AM

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Monday

1

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Monday

1

What are graphical models?

Monday

2

What is the penalty for a late submission?

Sunday

2

What are Bayesian Networks?

Sunday

2

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2

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question @26

stop following 1 view

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