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AAI EXPERIMENT NO 1 : Design And Implement Hidden Markov Models for outcome prediction In Python

```
!pip install hmmlearn
import numpy as np
from hmmlearn.hmm import MultinomialHMM
observations = np.array([
[0], [1], [2], [1], [0], [2], [2], [1], [0]
])
lengths = [len(observations)]
model = MultinomialHMM(
n_components=3,
n_iter=200,
random_state=42
)
model.fit(observations, lengths)
hidden_states = model.predict(observations)
print("Observed sequence:")
print(observations.flatten())
print("\nPredicted hidden states:")
print(hidden_states)
last_state = hidden_states[-1]
next_state_probabilities = model.transmat_[last_state]
predicted_next_state = np.argmax(next_state_probabilities)
print("\nTransition probabilities from last state:")
print(next_state_probabilities)
print("\nPredicted next hidden state:")
print(predicted_next_state)
# ----------------------------
# 6. Model Parameters
# ----------------------------
print("\nInitial state probabilities:")
print(model.startprob_)
print("\nTransition matrix:")
print(model.transmat_)
print("\nEmission matrix:")
print(model.emissionprob_)
```

```
Collecting hmmlearn
  Downloading hmmlearn-0.3.3-cp312-cp312-manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (3.0 kB)
Requirement already satisfied: numpy>=1.10 in /usr/local/lib/python3.12/dist-packages (from hmmlearn) (2.0.2)
Requirement already satisfied: scikit-learn!=0.22.0,>=0.16 in /usr/local/lib/python3.12/dist-packages (from hmmlearn) (1.6.1)
Requirement already satisfied: scipy>=0.19 in /usr/local/lib/python3.12/dist-packages (from hmmlearn) (1.16.3)
Requirement already satisfied: joblib>=1.2.0 in /usr/local/lib/python3.12/dist-packages (from scikit-learn!=0.22.0,>=0.16->hmmlearn) (1.5.3)
Requirement already satisfied: threadpoolctl>=3.1.0 in /usr/local/lib/python3.12/dist-packages (from scikit-learn!=0.22.0,>=0.16->hmmlearn) (3.6.0)
Downloading hmmlearn-0.3.3-cp312-cp312-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (165 kB)
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Installing collected packages: hmmlearn
Successfully installed hmmlearn-0.3.3
WARNING:hmmlearn.hmm:MultinomialHMM has undergone major changes. The previous version was implementing a CategoricalHMM (a special case of MultinomialHMM). Thi
https://github.com/hmmlearn/hmmlearn/issues/335
https://github.com/hmmlearn/hmmlearn/issues/340
Observed sequence:
[0 1 2 1 0 2 2 1 0]

Predicted hidden states:
[1 0 1 0 1 0 1 0 1]

Transition probabilities from last state:
[0.95463874 0.00797929 0.03738197]

Predicted next hidden state:
0

Initial state probabilities:
[0.1140845  0.87766916 0.00824634]

Transition matrix:
[[9.01320140e-04 9.99058562e-01 4.01179591e-05]
 [9.54638745e-01 7.97928839e-03 3.73819670e-02]
 [4.02174984e-01 1.24429527e-01 4.73395489e-01]]

Emission matrix:
[[1.]
 [1.]
 [1.]]
```