NLP Exp-8 Dikshant Buwa CSE-DS RollNo-4 VCET

```
import torch
import torch.nn as nn
import torch.optim as optim
```

Sample data (context and senses)

```
data = [
    (["The", "bank", "by", "the", "river", "is", "steep."], "financial_institution"),
    (["I", "walked", "along", "the", "river", "bank", "yesterday."], "river_bank"),
]
```

Create a vocabulary

```
vocab = set(word for context, _ in data for word in context)
word_to_idx = {word: idx for idx, word in enumerate(vocab)}
idx_to_word = {idx: word for word, idx in word_to_idx.items()}
```

Map sense labels to integers

```
sense_labels = list(set(label for _, label in data))
sense_to_idx = {sense: idx for idx, sense in enumerate(sense_labels)}
idx_to_sense = {idx: sense for sense, idx in sense_to_idx.items()}
```

Convert data to tensors

```
data_tensors = [(torch.tensor([word_to_idx[word] for word in context]), torch.tensor(sense_to_idx[sense])) for context, sense in data]
```

Define the LSTM-based WSD model

```
class WSDModel(nn.Module):
    def __init__(self, vocab_size, embedding_dim, hidden_dim, sense_count):
        super(WSDModel, self).__init__()
        self.embedding = nn.Embedding(vocab_size, embedding_dim)
        self.lstm = nn.LSTM(embedding_dim, hidden_dim)
        self.fc = nn.Linear(hidden_dim, sense_count)

    def forward(self, context):
        embedded = self.embedding(context)
        lstm_out, _ = self.lstm(embedded.view(len(context), 1, -1))
        prediction = self.fc(lstm_out[-1])
        return prediction
```

Hyperparameters

```
vocab_size = len(vocab)
embedding_dim = 100
hidden_dim = 64
sense_count = len(sense_labels)
learning_rate = 0.001
epochs = 10
```

Initialize the model

```
model = WSDModel(vocab_size, embedding_dim, hidden_dim, sense_count)
```

Define the loss function and optimizer

```
criterion = nn.CrossEntropyLoss()
optimizer = optim.Adam(model.parameters(), lr=learning_rate)
```

Training loop

```
def train(model, data, criterion, optimizer, epochs):
    model.train()
    for epoch in range(epochs):
        total_loss = 0
        for context, target_sense in data:
            optimizer.zero_grad()
            output = model(context)
            loss = criterion(output, target_sense.unsqueeze(0))  # Add batch dimension to target
            loss.backward()
            optimizer.step()
            total_loss += loss.item()
        print(f"Epoch {epoch + 1}/{epochs}, Loss: {total_loss / len(data)}")
```

Train the model

```
train(model, data_tensors, criterion, optimizer, epochs)
```

```
Epoch 1/10, Loss: 0.6757958233356476
Epoch 2/10, Loss: 0.558686763048172
Epoch 3/10, Loss: 0.4687323123216629
Epoch 4/10, Loss: 0.3922365605831146
Epoch 5/10, Loss: 0.3269917070865631
Epoch 6/10, Loss: 0.2715676426887512
Epoch 7/10, Loss: 0.22474747896194458
Epoch 8/10, Loss: 0.1854453757405281
Epoch 9/10, Loss: 0.15267889201641083
Epoch 10/10, Loss: 0.12555241212248802
```

Inference (predict senses for new contexts)

```
with torch.no_grad():
    new_context = ["The", "bank", "charges", "high", "fees."]
    new_context = torch.tensor([word_to_idx.get(word, 0) for word in new_context])
    new_context = new_context.unsqueeze(0)  # Add batch dimension
    predictions = model(new_context)
    predicted_label = idx_to_sense[torch.argmax(predictions).item()]
    print(f"Predicted sense: {predicted_label}")
```

```
Predicted sense: river_bank
```