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import numpy as np
import matplotlib.pyplot as plt
from sklearn.mixture import GaussianMixture
from sklearn.datasets import make_blobs
from sklearn.metrics import silhouette_score

# Generate synthetic data with 3 clusters
X, y_true = make_blobs(n_samples=300, centers=3, cluster_std=0.60,
random_state=0)

# Fit a Gaussian Mixture Model using EM algorithm
gmm = GaussianMixture(n_components=3, random_state=0)
gmm.fit(X)

# Predict cluster labels
labels = gmm.predict(X)

# Evaluate clustering
print("Cluster Centers:\n", gmm.means_)
print("Silhouette Score:", silhouette_score(X, labels))

# Visualize clusters
plt.scatter(X[:, 0], X[:, 1], c=labels, s=40, cmap='viridis')
plt.scatter(gmm.means_[:, 0], gmm.means_[:, 1], s=100, c='red',
marker='X', label='Centroids')
plt.title("Clustering using EM (GMM)")
plt.xlabel("Feature 1")
plt.ylabel("Feature 2")
plt.legend()
plt.show()
```