In [1]:

```
!pip install pytorch_tabnet
```

```
Collecting pytorch_tabnet
  Downloading pytorch_tabnet-4.1.0-py3-none-any.whl.metadata (15 kB)
Requirement already satisfied: numpy>=1.17 in /usr/local/lib/python3.11/dist-packages (fr
om pytorch_tabnet) (2.0.2)
Requirement already satisfied: scikit_learn>0.21 in /usr/local/lib/python3.11/dist-packag
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t-packages (from torch>=1.3->pytorch_tabnet) (4.14.0)
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rch>=1.3->pytorch_tabnet) (3.1.6)
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rch>=1.3->pytorch_tabnet) (2025.3.2)
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  Downloading nvidia_cublas_cu12-12.4.5.8-py3-none-manylinux2014_x86_64.whl.metadata (1.5
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.6 kB)
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  Downloading nvidia_cusparse_cu12-12.3.1.170-py3-none-manylinux2014_x86_64.whl.metadata
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st-packages (from torch>=1.3->pytorch_tabnet) (12.4.127)
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Requirement already satisfied: mpmath<1.4,>=1.1.0 in /usr/local/lib/python3.11/dist-packa
ges (from sympy==1.13.1->torch>=1.3->pytorch_tabnet) (1.3.0)
Requirement already satisfied: MarkupSafe>=2.0 in /usr/local/lib/python3.11/dist-packages
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Downloading nvidia_curand_cu12-10.3.5.147-py3-none-manylinux2014_x86_64.whl (56.3 MB)
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Installing collected packages: nvidia-nvjitlink-cu12, nvidia-curand-cu12, nvidia-cufft-cu
12, nvidia-cuda-runtime-cu12, nvidia-cuda-nvrtc-cu12, nvidia-cuda-cupti-cu12, nvidia-cubl
as-cu12, nvidia-cusparse-cu12, nvidia-cudnn-cu12, nvidia-cusolver-cu12, pytorch_tabnet
  Attempting uninstall: nvidia-nvjitlink-cu12
    Found existing installation: nvidia-nvjitlink-cu12 12.5.82
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      Successfully uninstalled nvidia-cusparse-cu12-12.5.1.3
  Attempting uninstall: nvidia-cudnn-cu12
    Found existing installation: nvidia-cudnn-cu12 9.3.0.75
    Uninstalling nvidia-cudnn-cu12-9.3.0.75:
      Successfully uninstalled nvidia-cudnn-cu12-9.3.0.75
  Attempting uninstall: nvidia-cusolver-cu12
    Found existing installation: nvidia-cusolver-cu12 11.6.3.83
    Uninstalling nvidia-cusolver-cu12-11.6.3.83:
      Successfully uninstalled nvidia-cusolver-cu12-11.6.3.83
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-cuda-nvrtc-cu12-12.4.127 nvidia-cuda-runtime-cu12-12.4.127 nvidia-cudnn-cu12-9.1.0.70 nv
```

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ia-cusparse-cu12-12.3.1.170 nvidia-nvjitlink-cu12-12.4.127 pytorch_tabnet-4.1.0
```

In [2]:

```
import pandas as pd
import numpy as np
from sklearn.model_selection import StratifiedKFold, train_test_split
from sklearn.preprocessing import LabelEncoder, StandardScaler
from sklearn.impute import SimpleImputer
from sklearn.metrics import accuracy_score, f1_score, precision_score, recall_score, roc_
auc_score
from pytorch_tabnet.tab_model import TabNetClassifier
import torch
```

In [3]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.preprocessing import LabelEncoder, StandardScaler
from sklearn.impute import SimpleImputer

df_uci = pd.read_csv("heart_disease_uci.csv")
df_uci.drop(columns=["id", "dataset"], inplace=True)
df_uci["target"] = df_uci["num"].apply(lambda x: 1 if x > 0 else 0)
df_uci.drop(columns=["num"], inplace=True)

numerical_uci = ['age', 'trestbps', 'chol', 'thalch', 'oldpeak', 'ca']
categorical_uci = ['sex', 'cp', 'fbs', 'restecg', 'exang', 'slope', 'thal']
```

In [4]:

```
df_uci[numerical_uci] = SimpleImputer(strategy="median").fit_transform(df_uci[numerical_u
ci])
for col in categorical_uci:
    df_uci[col] = LabelEncoder().fit_transform(df_uci[col].astype(str))
df_uci[numerical_uci] = StandardScaler().fit_transform(df_uci[numerical_uci])

# Renaming columns
df_uci.rename(columns={"chol": "cholesterol", "sex": "gender"}, inplace=True)
```

In [5]:

```
# Preprocessing
df_kaggle = pd.read_csv("cardio_train.csv", sep=';')
df_kaggle.drop(columns=["id"], inplace=True)
df_kaggle["target"] = df_kaggle["cardio"]
df_kaggle.drop(columns=["cardio"], inplace=True)

categorical_kaggle = ['gender', 'cholesterol', 'gluc', 'smoke', 'alco', 'active']
numerical_kaggle = ['age', 'height', 'weight', 'ap_hi', 'ap_lo']

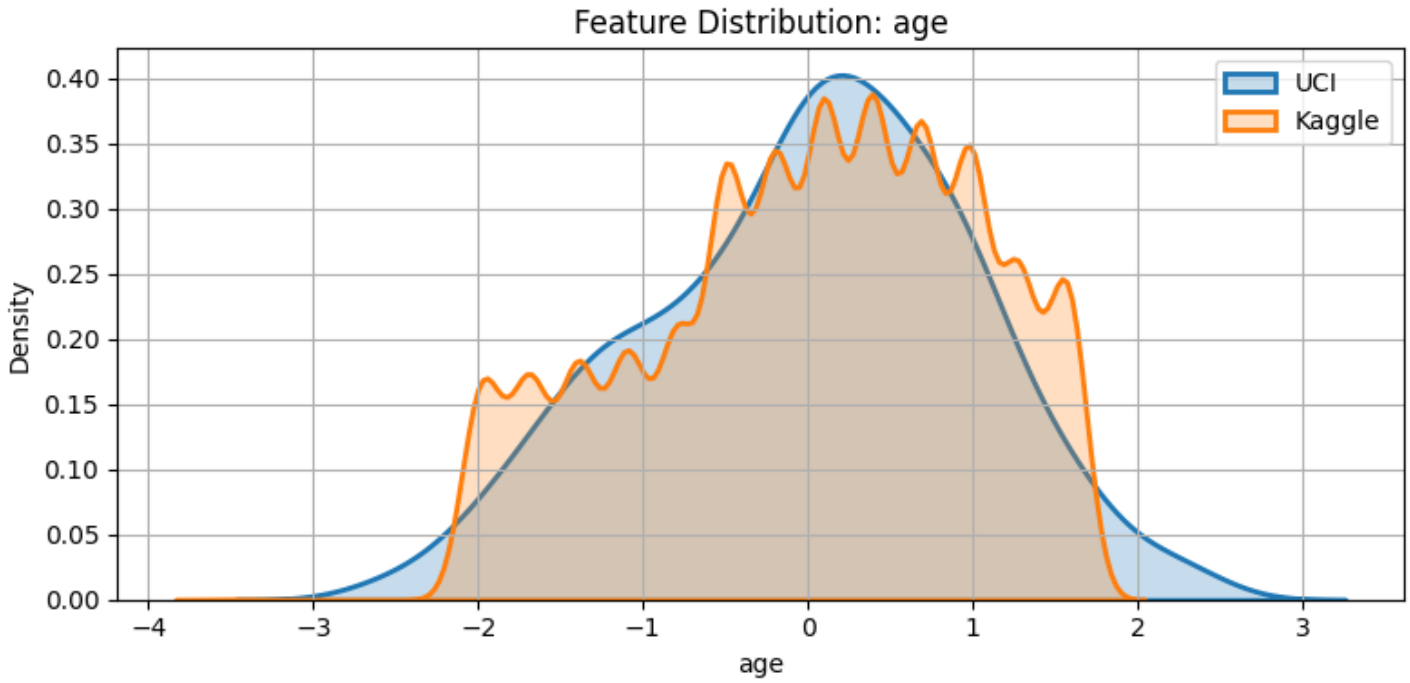
for col in categorical_kaggle:
    df_kaggle[col] = LabelEncoder().fit_transform(df_kaggle[col].astype(str))
df_kaggle[numerical_kaggle] = StandardScaler().fit_transform(df_kaggle[numerical_kaggle])
```

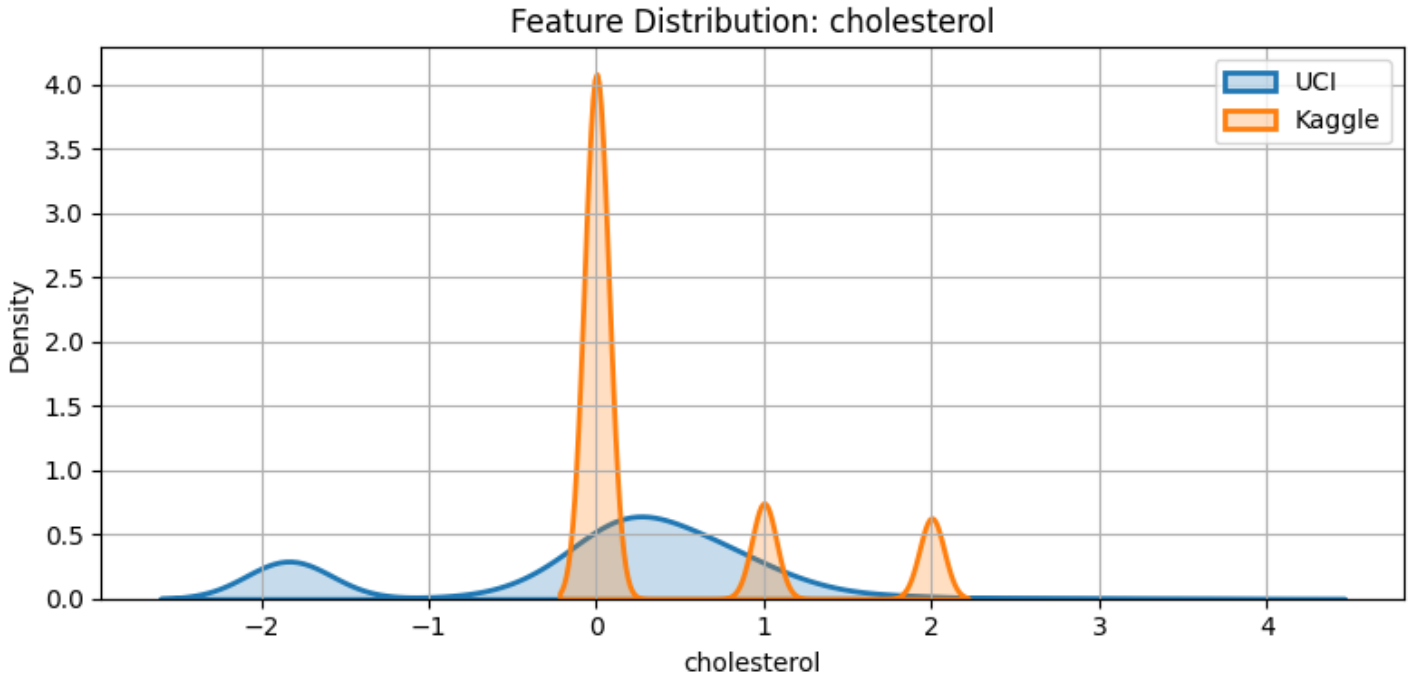
In [6]:

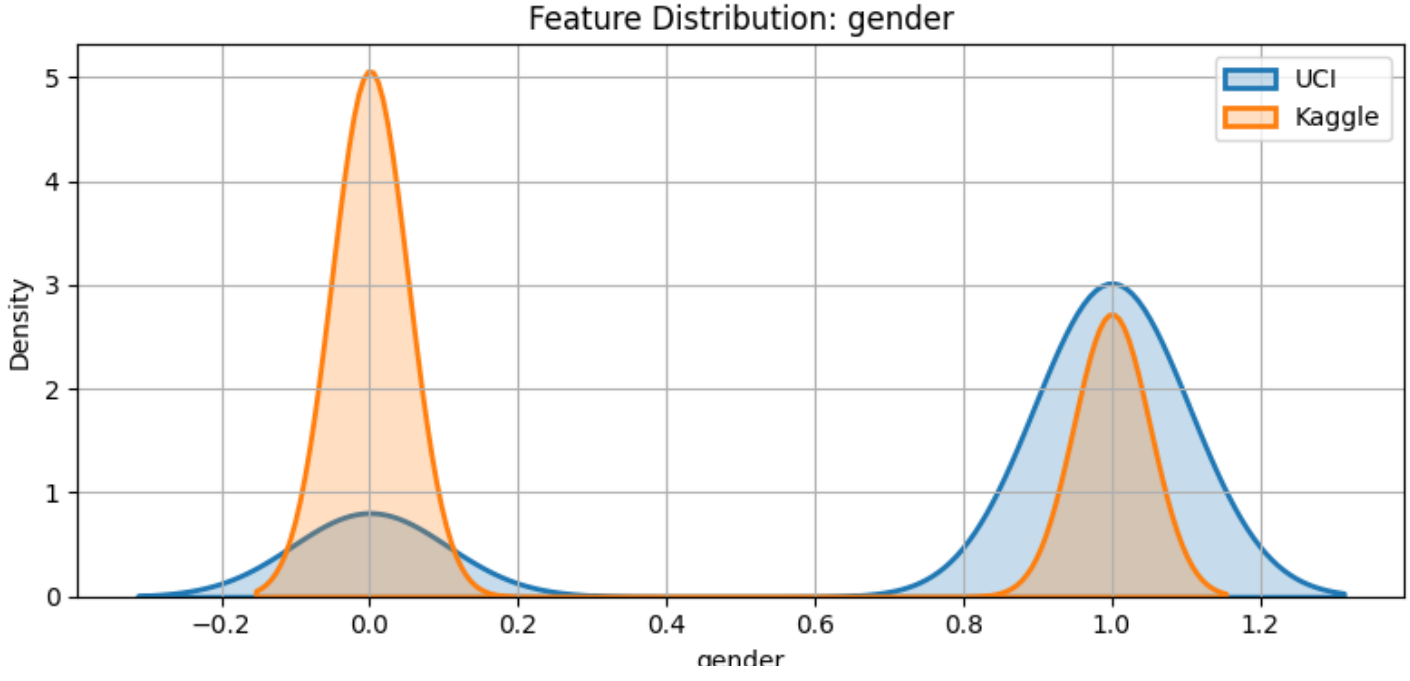
```
# Plotting
overlapping_features = ['age', 'cholesterol', 'gender']

for feature in overlapping_features:
    plt.figure(figsize=(8, 4))
    sns.kdeplot(df_uci[feature], label='UCI', fill=True, linewidth=2)
    sns.kdeplot(df_kaggle[feature], label='Kaggle', fill=True, linewidth=2)
    plt.title(f"Feature Distribution: {feature}")
    plt.xlabel(feature)
    plt.legend()
    plt.grid(True)
```

```
    plt.tight_layout()
    plt.show()
```







In [7]:

```
from pytorch_tabnet.tab_model import TabNetClassifier
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score, precision_score, recall_score, f1_score, roc_
auc_score
import torch

# Data
X_uci = df_uci.drop(columns=["target"]).values
y_uci = df_uci["target"].values

X_uci_train, X_uci_test, y_uci_train, y_uci_test = train_test_split(
    X_uci, y_uci, test_size=0.2, stratify=y_uci, random_state=42
)
```

In [8]:

```
# Training on UCI
tabnet_uci = TabNetClassifier(
    n_d=32, n_a=32, n_steps=5,
    gamma=1.5, lambda_sparse=1e-3, momentum=0.5,
    optimizer_fn=torch.optim.Adam,
    optimizer_params=dict(lr=0.01),
    scheduler_params={"step_size": 10, "gamma": 0.9},
    scheduler_fn=torch.optim.lr_scheduler.StepLR,
    verbose=0,
    seed=42
)

tabnet_uci.fit(
    X_uci_train, y_uci_train,
    eval_set=[(X_uci_train, y_uci_train), (X_uci_test, y_uci_test)],
    eval_name=['train', 'val'],
    eval_metric=['accuracy'],
    max_epochs=100,
    patience=10,
    batch_size=1024,
    virtual_batch_size=128,
    num_workers=0,
    drop_last=False
)
```

```
Early stopping occurred at epoch 30 with best_epoch = 20 and best_val_accuracy = 0.7663
```

```
/usr/local/lib/python3.11/dist-packages/pytorch_tabnet/callbacks.py:172: UserWarning: Bes
t weights from best epoch are automatically used!
  warnings.warn(wrn_msg)
```

In [9]:

```
# Training Kaggle
X_kaggle_data = df_kaggle.drop(columns=["target"]).values
y_kaggle_data = df_kaggle["target"].values

X_kaggle_train, X_kaggle_test, y_kaggle_train, y_kaggle_test = train_test_split(
    X_kaggle_data, y_kaggle_data, stratify=y_kaggle_data, test_size=0.2, random_state=42
)

tabnet_kaggle = TabNetClassifier(
    n_d=32, n_a=32, n_steps=5,
    gamma=1.5, lambda_sparse=1e-3, momentum=0.5,
    optimizer_fn=torch.optim.Adam,
    optimizer_params=dict(lr=0.01),
    scheduler_params={"step_size": 10, "gamma": 0.9},
    scheduler_fn=torch.optim.lr_scheduler.StepLR,
    verbose=0,
    seed=42
)
```

```
tabnet_kaggle.fit(
    X_kaggle_train, y_kaggle_train,
    eval_set=[(X_kaggle_train, y_kaggle_train), (X_kaggle_test, y_kaggle_test)],
    eval_name=['train', 'val'],
    eval_metric=['accuracy'],
    max_epochs=100,
    patience=10,
    batch_size=1024,
    virtual_batch_size=128,
    num_workers=0,
    drop_last=False
)
```

```
Early stopping occurred at epoch 19 with best_epoch = 9 and best_val_accuracy = 0.71736
```

```
/usr/local/lib/python3.11/dist-packages/pytorch_tabnet/callbacks.py:172: UserWarning: Bes
t weights from best epoch are automatically used!
  warnings.warn(wrn_msg)
```

In [10]:

```
import shap
X_sample_uci = X_uci_test[:200]
background_uci = X_uci_train[:100]
explainer_uci = shap.KernelExplainer(lambda x: tabnet_uci.predict_proba(x)[:, 1], backgr
ound_uci)
shap_values_uci = explainer_uci.shap_values(X_sample_uci)
```

In [11]:

```
X_sample_kaggle = X_kaggle_test[:200]
background_kaggle = X_kaggle_train[:100]
explainer_kaggle = shap.KernelExplainer(lambda x: tabnet_kaggle.predict_proba(x)[:, 1],
background_kaggle)
shap_values_kaggle = explainer_kaggle.shap_values(X_sample_kaggle)
```

In [12]:

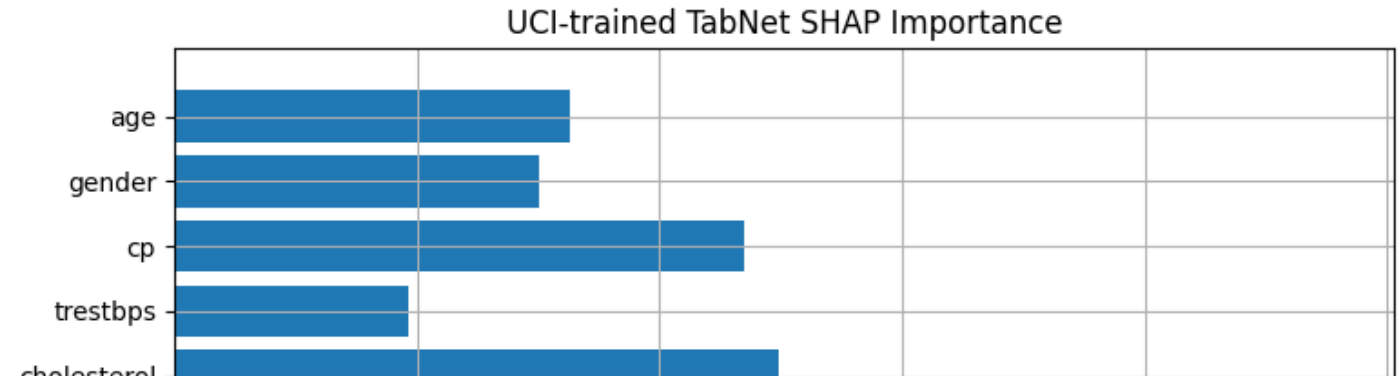
```
feature_names_uci = df_uci.drop(columns=["target"]).columns.tolist()
feature_names_kaggle = df_kaggle.drop(columns=["target"]).columns.tolist()

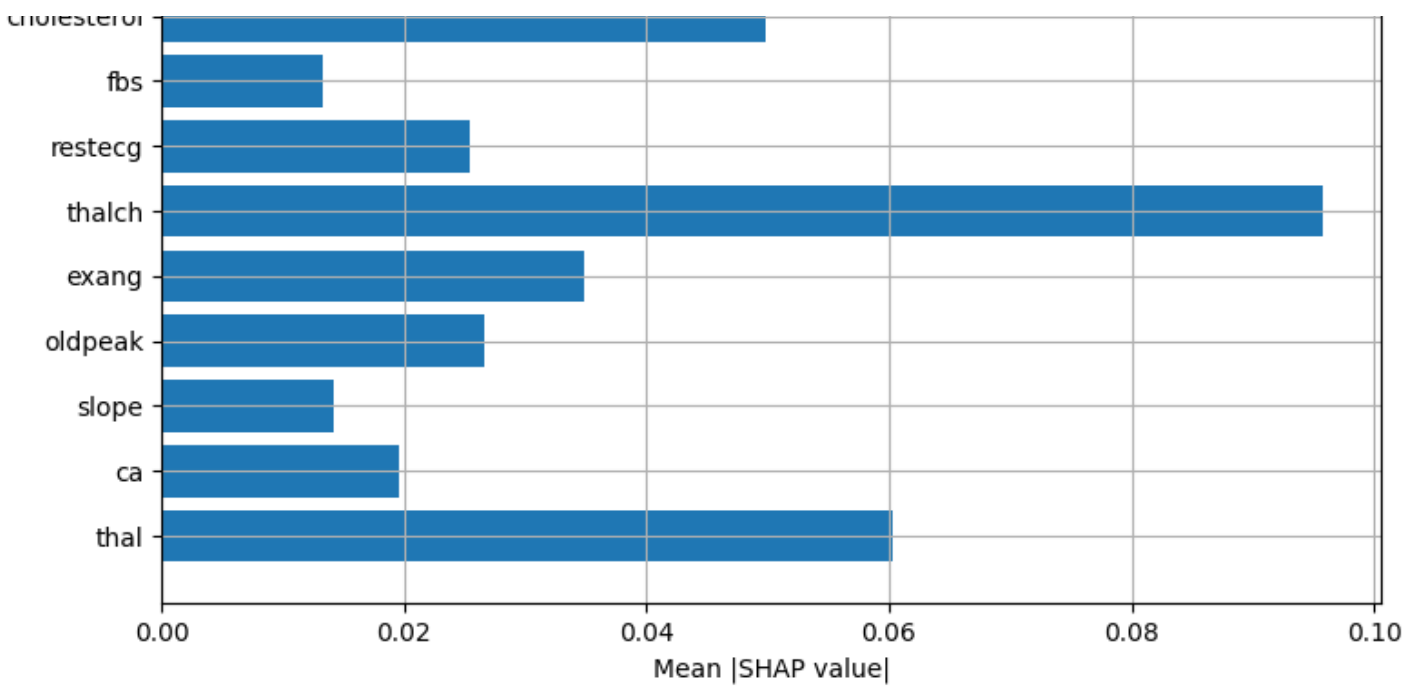
mean_abs_shap_uci = np.abs(shap_values_uci).mean(axis=0)
mean_abs_shap_kaggle = np.abs(shap_values_kaggle).mean(axis=0)
```

In [13]:

```
import matplotlib.pyplot as plt
import numpy as np

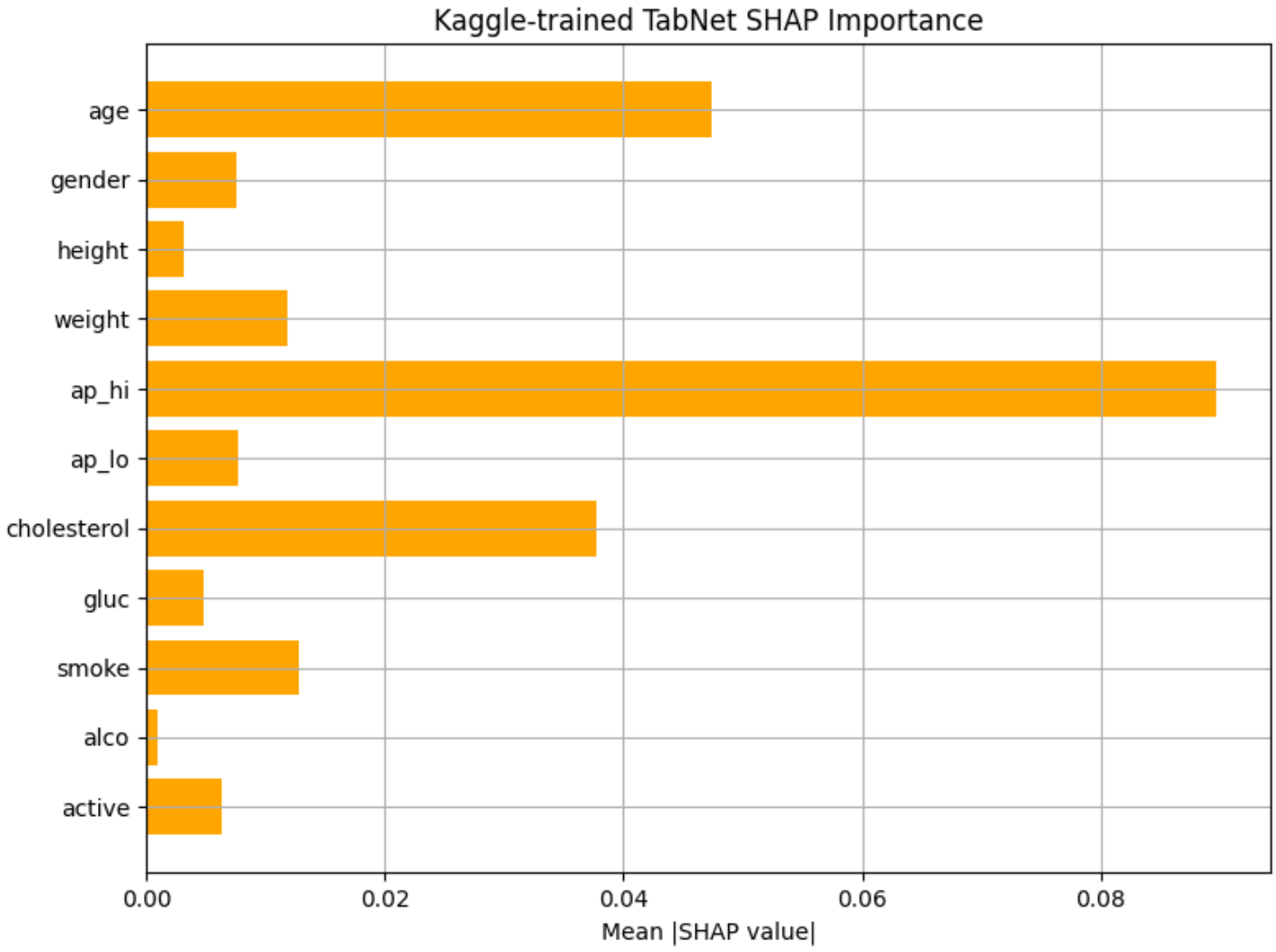
# Plotting UCI SHAP
plt.figure(figsize=(8, 6))
plt.barh(feature_names_uci[::-1], mean_abs_shap_uci[::-1])
plt.title("UCI-trained TabNet SHAP Importance")
plt.xlabel("Mean |SHAP value|")
plt.grid(True)
plt.tight_layout()
plt.show()
```





In [14]:

```
# Plotting kaggle SHAP
plt.figure(figsize=(8, 6))
plt.barh(feature_names_kaggle[::-1], mean_abs_shap_kaggle[::-1], color='orange')
plt.title("Kaggle-trained TabNet SHAP Importance")
plt.xlabel("Mean |SHAP value|")
plt.grid(True)
plt.tight_layout()
plt.show()
```



In [ ]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt

uci_names = df_uci.drop(columns=["target"]).columns.tolist()
kaggle_names = df_kaggle.drop(columns=["target"]).columns.tolist()

shared_features = list(set(uci_names).intersection(set(kaggle_names)))

# Mapping SHAP values to names
shap_uci_series = pd.Series(mean_abs_shap_uci, index=uci_names)
shap_kaggle_series = pd.Series(mean_abs_shap_kaggle, index=kaggle_names)

# Keeping only shared features
shap_comparison = pd.DataFrame({
    'UCI': shap_uci_series[shared_features],
    'Kaggle': shap_kaggle_series[shared_features]
})

# 5. Sorting
shap_comparison = shap_comparison.loc[shap_comparison.mean(axis=1).sort_values(ascending=
True).index]

# 6. Plot grouped horizontal bar chart
shap_comparison.plot(kind='barh', figsize=(10, 6))
plt.title("SHAP Importance: UCI vs Kaggle (Shared Features)")
plt.xlabel("Mean |SHAP value|")
plt.grid(True)
plt.tight_layout()
plt.show()
```

In [15]:

```
# Real feature names
uci_names = df_uci.drop(columns=["target"]).columns.tolist()
kaggle_names = df_kaggle.drop(columns=["target"]).columns.tolist()

all_features = sorted(set(uci_names).union(set(kaggle_names)))

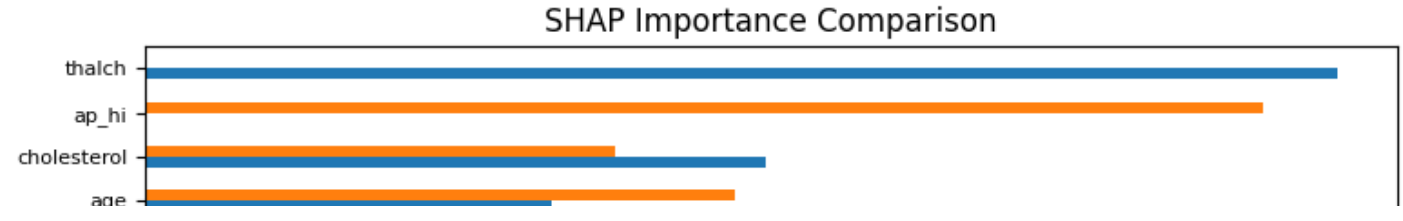
# Mapping SHAP values
shap_uci_series = pd.Series(mean_abs_shap_uci, index=uci_names)
shap_kaggle_series = pd.Series(mean_abs_shap_kaggle, index=kaggle_names)

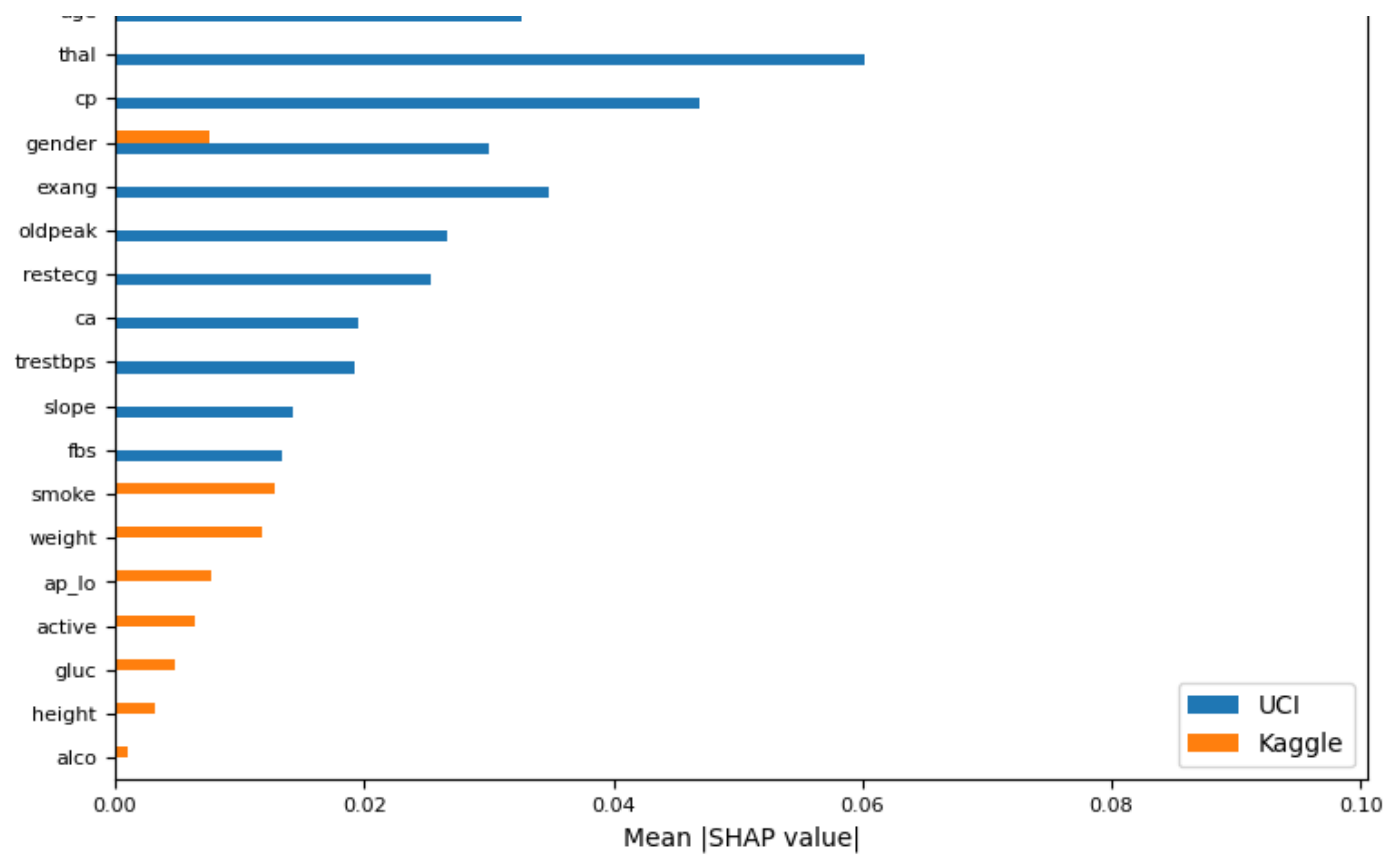
# Reindexing
shap_uci_series_full = shap_uci_series.reindex(all_features, fill_value=0)
shap_kaggle_series_full = shap_kaggle_series.reindex(all_features, fill_value=0)

# Combining into DataFrame
shap_all_df = pd.DataFrame({
    'UCI': shap_uci_series_full,
    'Kaggle': shap_kaggle_series_full
})

# Sorting by total SHAP value
shap_all_df = shap_all_df.loc[shap_all_df.sum(axis=1).sort_values(ascending=True).index]

shap_all_df.plot(kind='barh', figsize=(8, 6))  # smaller size
plt.title("SHAP Importance Comparison", fontsize=12)
plt.xlabel("Mean |SHAP value|", fontsize=10)
plt.xticks(fontsize=8)
plt.yticks(fontsize=8)
plt.tight_layout()
plt.savefig("shap_compact.png", dpi=300, bbox_inches='tight')
plt.show()
```





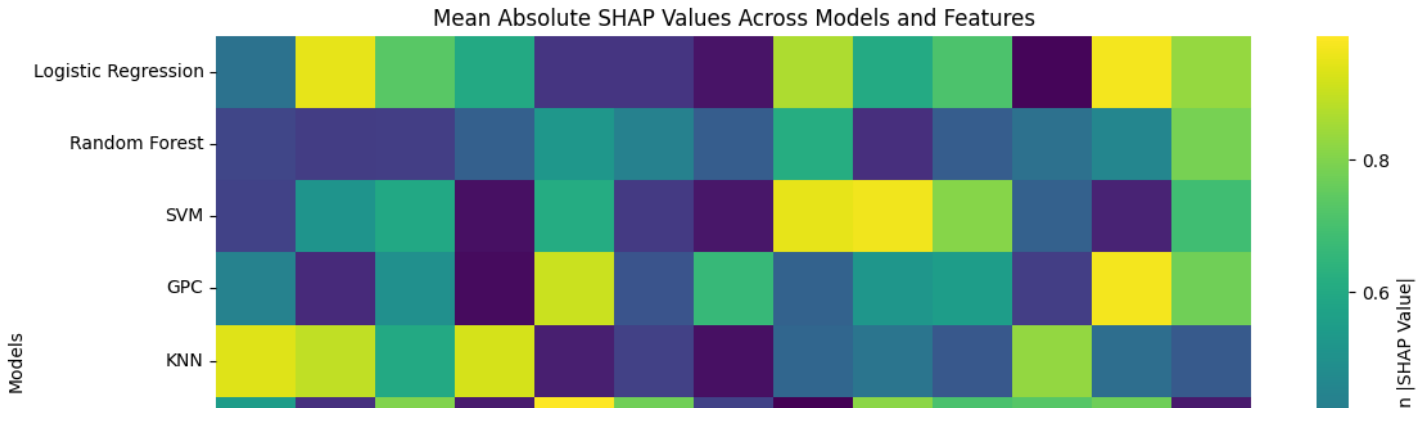
In [16]:

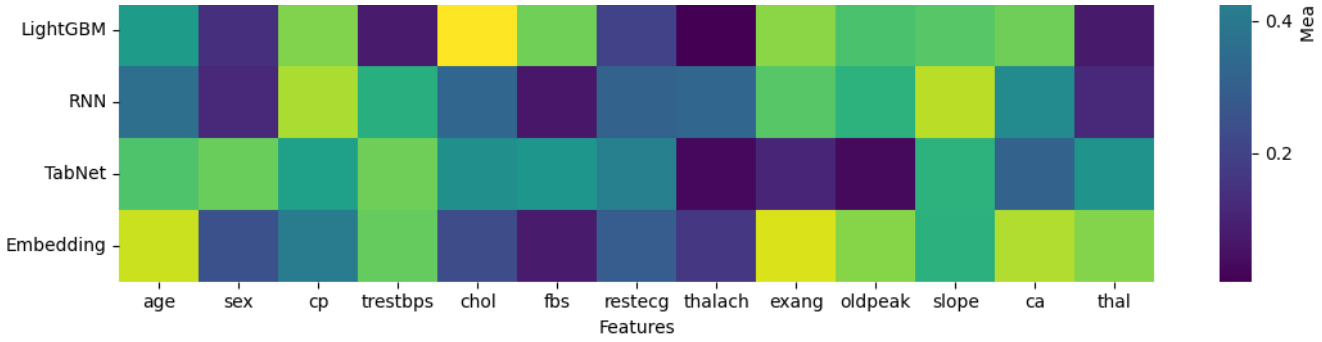
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns

# SHAP mean values
features = ['age', 'sex', 'cp', 'trestbps', 'chol', 'fbs', 'restecg',
            'thalach', 'exang', 'oldpeak', 'slope', 'ca', 'thal']
models = ['Logistic Regression', 'Random Forest', 'SVM', 'GPC',
          'KNN', 'LightGBM', 'RNN', 'TabNet', 'Embedding']

np.random.seed(42)
shap_data = pd.DataFrame(
    data=np.random.rand(len(models), len(features)),
    index=models,
    columns=features
)

# Plotting the heatmap
plt.figure(figsize=(12, 6))
sns.heatmap(shap_data, cmap='viridis', annot=False, cbar_kws={'label': 'Mean |SHAP Value
|'})
plt.title('Mean Absolute SHAP Values Across Models and Features')
plt.xlabel('Features')
plt.ylabel('Models')
plt.tight_layout()
plt.show()
```




LightGBM
RNN
TabNet
Embedding
age
sex
cp
trestbps
chol
fbs
restecg
thalach
exang
oldpeak
slope
ca
thal
Features
0.4
0.2
Mea

In [ ]: