In [3]:
```
import matplotlib.pyplot as plt
import numpy as np
import tensorflow as tf
from tensorflow import keras
from tensorflow.keras import layers
from tensorflow.keras.layers import Embedding,SimpleRNN,LSTM,GRU,Dense
from tensorflow.keras.models import Sequential
from tensorflow.keras.datasets import imdb
```

```
WARNING:tensorflow:From C:\Users\user\anaconda3\Lib\site-packages\keras\src\losses.py:2976: The name tf.losses.spars
e_softmax_cross_entropy is deprecated. Please use tf.compat.v1.losses.sparse_softmax_cross_entropy instead.
```

In [49]:
```
def decode_review(review):
    return ' '.join([reverse_word_index.get(i-3,'?') for i in review])
```

In [8]:
```
def load_imdb_data(max_features,maxlen):
    (x_train,y_train),(x_test,y_test)=imdb.load_data(num_words=max_features)
    x_train=tf.keras.preprocessing.sequence.pad_sequences(x_train,maxlen=maxlen)
    x_test=tf.keras.preprocessing.sequence.pad_sequences(x_test,maxlen=maxlen)
    return x_train,y_train,x_test,y_test
```

In [23]:
```
def rnn_model(max_features,maxlen):
    model=Sequential([
        Embedding(max_features,32,input_length=maxlen),
        SimpleRNN(32),
        Dense(1,activation='sigmoid')
    ])
    model.compile(loss='binary_crossentropy',optimizer='adam',metrics=['accuracy'])
    return model
```

In [36]:
```
def lstm_model(max_features,maxlen):
    model=Sequential([
        Embedding(max_features,32,input_length=maxlen),
        LSTM(32),
        Dense(1,activation='sigmoid')
    ])
    model.compile(loss='binary_crossentropy',optimizer='adam',metrics=['accuracy'])
    return model
```

In [37]:
```
def gru_model(max_features,maxlen):
    model=Sequential([
        Embedding(max_features,32,input_length=maxlen),
        GRU(32),
        Dense(1,activation='sigmoid')
    ])
    model.compile(loss='binary_crossentropy',optimizer='adam',metrics=['accuracy'])
    return model
```

In [50]:
```
def training_and_evaluation(model,x_train,y_train,x_test,y_test,epochs=3,batch_size=128):
    history=model.fit(x_train,y_train,epochs=epochs,batch_size=batch_size,validation_split=0.2,verbose=2)
    loss,accuracy=model.evaluate(x_test,y_test,verbose=0)
    for i in range(2):
        index=np.random.randint(0,len(x_test))
        review=x_test[index]
        actual_label=y_test[index]
        probab=model.predict(np.expand_dims(review,axis=0))[0,0]
        print(f'review{decode_review(review)}')
        label=1 if probab>0.5 else 0
        print(f'review{i+1}')
        print(f'actual_label{actual_label}')
        print(f'predicted_label{label}')
    return history,loss,accuracy
```

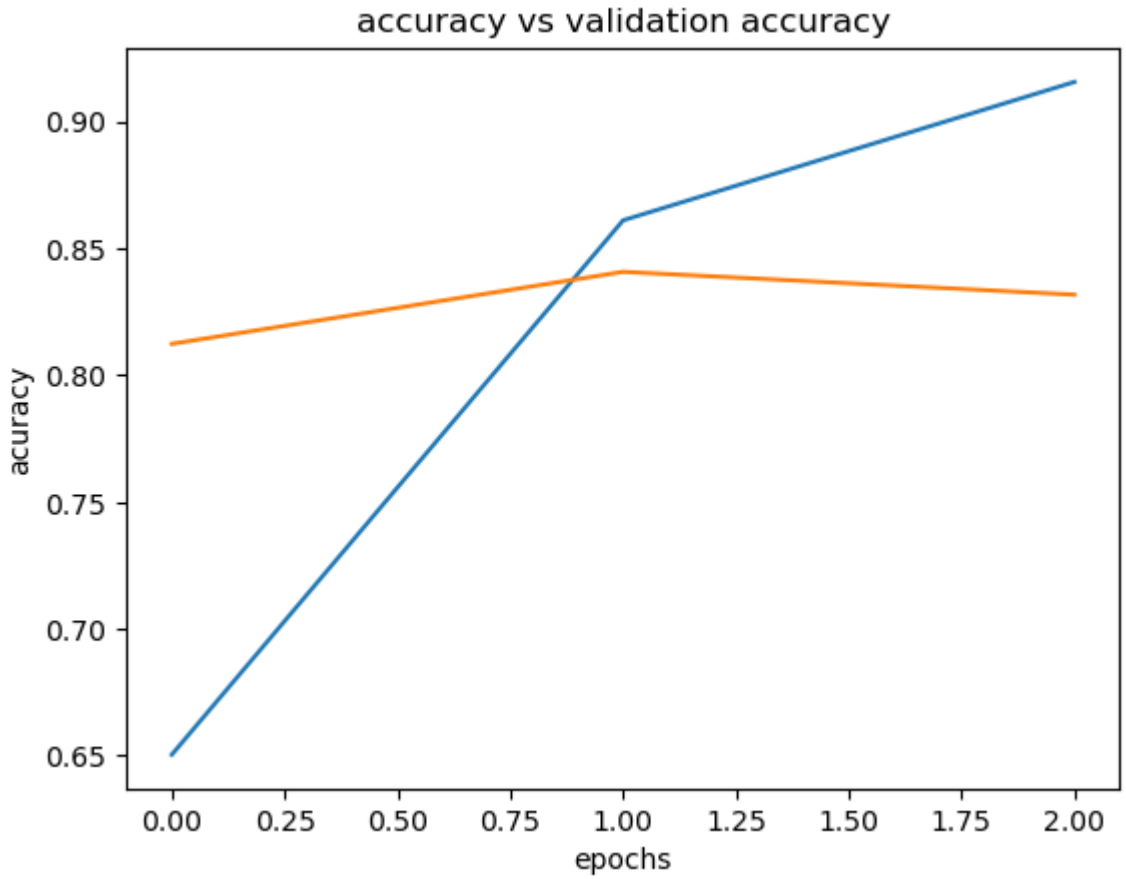
In [46]:
```
max_features=10000
maxlen=100
```

In [55]:
```
def plotting(history,model_name):
    print(f'model:  {model_name}')
    print(f'accuracy:  {accuracy}')
    print(f'loss:  {loss}')
    plt.title(f'accuracy vs validation accuracy')
    plt.plot(history.history['accuracy'],label='training accuracy')
    plt.plot(history.history['val_accuracy'],label='validation accuracy')
    plt.xlabel('epochs')
    plt.ylabel('acuracy')
    plt.show()
```

In [56]:
```
word_index=imdb.get_word_index()
reverse_word_index=dict([(value,key) for (key,value) in word_index.items()])

x_train,y_train,x_test,y_test=load_imdb_data(max_features,maxlen)
rnn=rnn_model(max_features,maxlen)
history,loss,accuracy=training_and_evaluation(rnn,x_train,y_train,x_test,y_test)
plotting(history,'rnn')
```

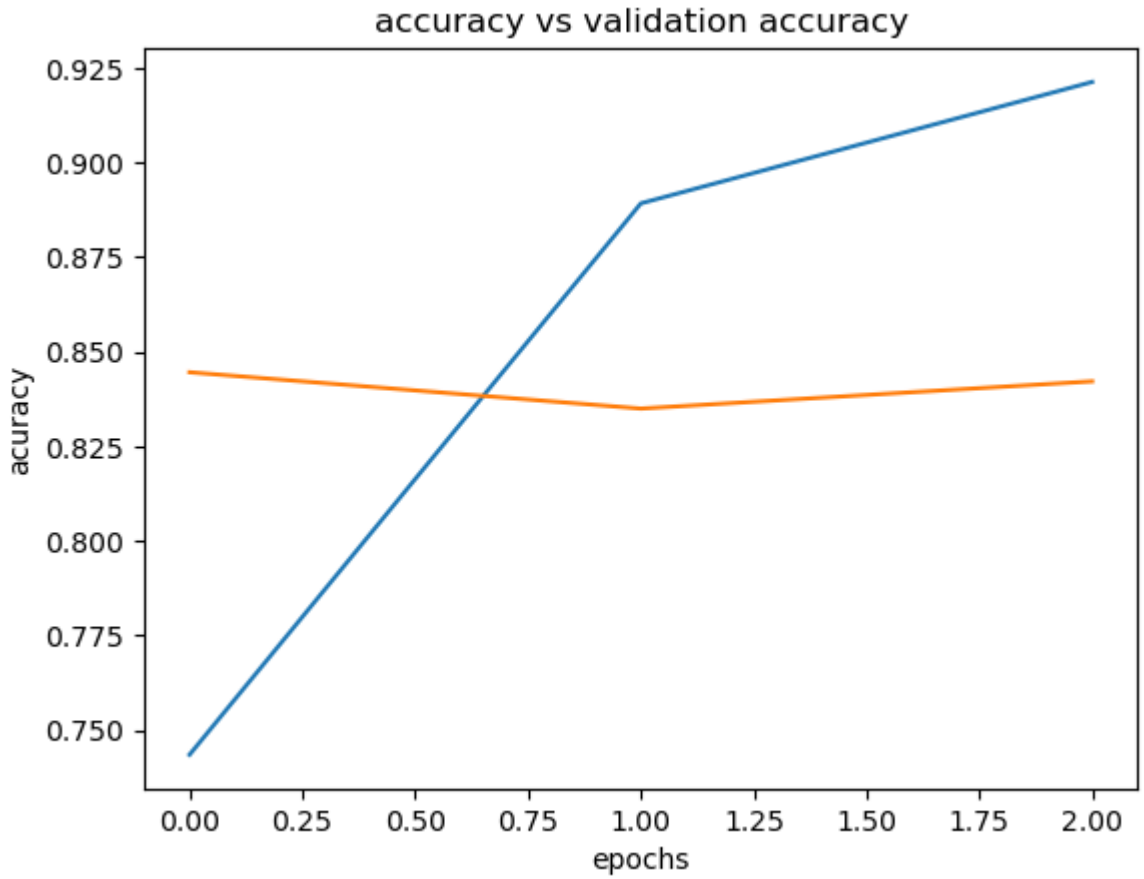
```
Epoch 1/3
157/157 - 11s - loss: 0.6040 - accuracy: 0.6504 - val_loss: 0.4256 - val_accuracy: 0.8124 - 11s/epoch - 67ms/step
Epoch 2/3
157/157 - 7s - loss: 0.3340 - accuracy: 0.8611 - val_loss: 0.3720 - val_accuracy: 0.8408 - 7s/epoch - 46ms/step
Epoch 3/3
157/157 - 7s - loss: 0.2247 - accuracy: 0.9157 - val_loss: 0.4037 - val_accuracy: 0.8318 - 7s/epoch - 42ms/step
1/1 [==============================] - 0s 330ms/step
reviewcould easily have been ? in his ultimately caring attitude ? keeps him sharp enough to keep him from being too
sweet but the revelation is stephen robertson as michael not since ? ? ? in gilbert ? has anyone so perfectly captur
ed a person with an ? that i began to believe he really was an actor with cerebral ? and his eyes my god he can rip
you apart with them br br this movie is to ? ? f ? amazing go see it take a box of ? and enjoy every well earned tea
r and laugh
review1
actual_label1
predicted_label1
1/1 [==============================] - 0s 63ms/step
reviewonly area of the film i enjoyed was the commentary on film making for the most part this film seemed random an
d somewhat ? i don't say that in a ? way however and just silly it was as if he was mixing fantasy with everyday lif
e which may sounds intriguing in some films but the fantasy merely seemed needlessly perverse br br my criticism of
this film is not upon the actors rather the story itself i found it boring and ? i wanted my money back but consider
ing it was a film festival that wasn't about to happen
review2
actual_label0
predicted_label0
model:  rnn
accuracy:  0.8271999955177307
loss:  0.40923866629600525
```


accuracy vs validation accuracy
acuracy
epochs
0.90
0.85
0.80
0.75
0.70
0.65
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00

In [57]:

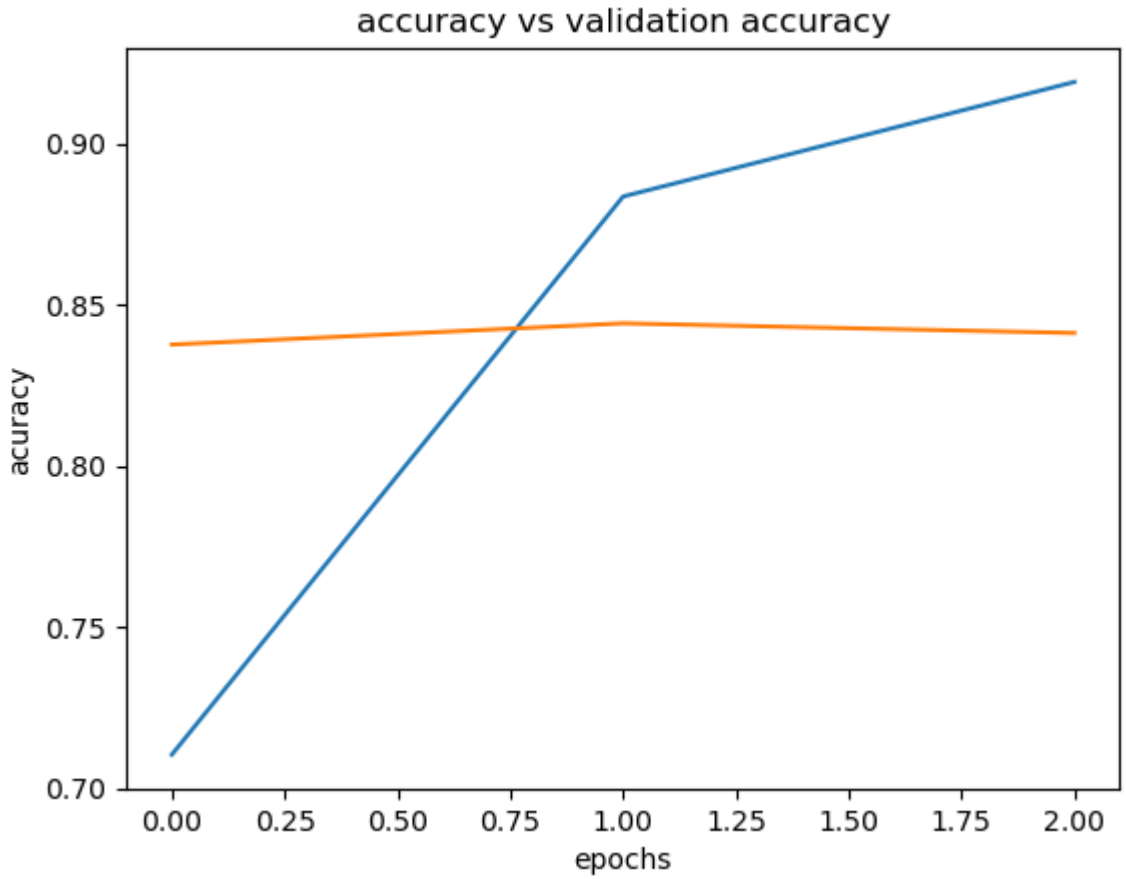
```
lstm=lstm_model(max_features,maxlen)
history,loss,accuracy=training_and_evaluation(lstm,x_train,y_train,x_test,y_test)
plotting(history,'lstm')
```

```
Epoch 1/3
157/157 - 21s - loss: 0.5020 - accuracy: 0.7435 - val_loss: 0.3513 - val_accuracy: 0.8446 - 21s/epoch - 131ms/step
Epoch 2/3
157/157 - 15s - loss: 0.2771 - accuracy: 0.8892 - val_loss: 0.3942 - val_accuracy: 0.8350 - 15s/epoch - 95ms/step
Epoch 3/3
157/157 - 15s - loss: 0.2114 - accuracy: 0.9214 - val_loss: 0.3571 - val_accuracy: 0.8422 - 15s/epoch - 97ms/step
1/1 [==============================] - 1s 1s/step
reviewand i did not understand the film my good ? friend wow what a long name explained every thing to me what a gre
at movie after watching this movie i felt i should have watched many more movies from ? ? film industry the war scen
es were amazing camera work excellent and plot beautiful the actress what a beauty give her an award for best lookin
g someone ? ? ? come on i smell a oscar winner i didnt understand the songs but they were excellent ? is a great dir
ector and i hope his next film was a success
review1
actual_label1
predicted_label1
1/1 [==============================] - 0s 68ms/step
reviewfeminine areas secondly ? her breasts after new york and new jersey ? some confusion as to whether miss is act
ually ? ? br br scene four ? is running she falls down this gives her ? cancer we always knew it could come back her
father says right ? cancer from ? perhaps i missed something as i said it's been a few years surely i missed somethi
ng didn't i for the love of god please tell me the girl did not contract ? cancer from falling down br br that screa
m you just heard was my soul dying
review2
actual_label0
predicted_label0
model:  lstm
accuracy:  0.8444399833679199
loss:  0.36172762513160706
```


accuracy vs validation accuracy
acuracy
epochs
0.925
0.900
0.875
0.850
0.825
0.800
0.775
0.750
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00

In [58]:
```
gru=gru_model(max_features,maxlen)
history,loss,accuracy=training_and_evaluation(gru,x_train,y_train,x_test,y_test)
plotting(history,'gru')
```

```
Epoch 1/3
157/157 - 21s - loss: 0.5277 - accuracy: 0.7103 - val_loss: 0.3646 - val_accuracy: 0.8376 - 21s/epoch - 132ms/step
Epoch 2/3
157/157 - 14s - loss: 0.2875 - accuracy: 0.8835 - val_loss: 0.3711 - val_accuracy: 0.8442 - 14s/epoch - 90ms/step
Epoch 3/3
157/157 - 14s - loss: 0.2163 - accuracy: 0.9191 - val_loss: 0.3737 - val_accuracy: 0.8412 - 14s/epoch - 89ms/step
1/1 [==============================] - 1s 880ms/step
reviewboy who is not in the military and has not trained to be a jet pilot takes off for a foreign country to rescue
his dad if this is not ridiculous enough he talks a colonel in the air force into helping him get his hands on a jet
wow to make the picture even more absurd the colonel risks his career and life by giving the ? ? some hands on aid t
hey not only don't make like this anymore but they never did this sappy corny film should be tossed into the air and
blown away by a
review1
actual_label0
predicted_label0
1/1 [==============================] - 0s 62ms/step
reviewchallenging rap ? into the camera filmed in mtv style fast cuts crazy camera angles tight close ups and animat
ion ? the dialogue might have been ? in the original languages of ? and than in the subtitles and i have no doubt th
at some of the contemporary ? references will slip over western heads as well as the cultural and political context
unless of course you are familiar with ? this kind of teen film may be a first for ? but it has been done before and
done better in other western countries la ? 1995 for example
review2
actual_label0
predicted_label1
model:  gru
accuracy:  0.8432000279426575
loss:  0.3779047131538391
```


accuracy vs validation accuracy
acuracy
0.90
0.85
0.80
0.75
0.70
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
epochs

In [ ]:

In [ ]: