LSTM_without_preprocessing

In [2]:
```
## LSTM without preprocessing
import pandas as pd
import numpy as np
import torch
from torch import cuda
import random
import os
import re
import string
import torch
from torch import nn
from collections import Counter
from sklearn.model_selection import train_test_split
from sklearn.metrics import f1_score, classification_report
from sklearn.utils.class_weight import compute_class_weight
from matplotlib import pyplot as plt
print(torch.__version__)
```

```
1.10.2
```

In [4]:
```
# data import
#Training_data
train_data = pd.read_csv(r"C:\Users\Sunny\Downloads\train.csv")
#test_data import
test_data = pd.read_csv(r"C:\Users\Sunny\Downloads\test.csv")
```

In [6]:
```
#Print out the columns name and remove the header
print(train_data.columns)
train_data.head(10)
```

```
Index(['id', 'keyword', 'location', 'text', 'target'], dtype='object')
```

Out[6]:

	id	keyword	location	text	target
0	1	NaN	NaN	Our Deeds are the Reason of this #earthquake M...	1
1	4	NaN	NaN	Forest fire near La Ronge Sask. Canada	1
2	5	NaN	NaN	All residents asked to 'shelter in place' are ...	1
3	6	NaN	NaN	13,000 people receive #wildfires evacuation or...	1
4	7	NaN	NaN	Just got sent this photo from Ruby #Alaska as ...	1
5	8	NaN	NaN	#RockyFire Update => California Hwy. 20 closed...	1
6	10	NaN	NaN	#flood #disaster Heavy rain causes flash flood...	1
7	13	NaN	NaN	I'm on top of the hill and I can see a fire in...	1
8	14	NaN	NaN	There's an emergency evacuation happening now ...	1
9	15	NaN	NaN	I'm afraid that the tornado is coming to our a...	1

In [7]:
```
#create Target
train_label = train_data.target.to_numpy()
y_train = train_label.reshape(-1)
train_data.drop(['id', 'keyword', 'location', 'target'], axis=1, inplace=True)
test_data.drop(['id', 'keyword', 'location'], axis=1, inplace=True)
train_data = train_data.to_numpy()
test_data = test_data.to_numpy()
x_train = train_data.reshape(-1)
x_test = test_data.reshape(-1)
print(x_train)
print(y_train)
```

```
['Our Deeds are the Reason of this #earthquake May ALLAH Forgive us all'
 'Forest fire near La Ronge Sask. Canada'
 "All residents asked to 'shelter in place' are being notified by officers. No other evacuation or shelter in
place orders are expected"
 ... 'M1.94 [01:04 UTC]?5km S of Volcano Hawaii. http://t.co/zDtoyd8EbJ'
 'Police investigating after an e-bike collided with a car in Little Portugal. E-bike rider suffered serious n
on-life threatening injuries.'
 'The Latest: More Homes Razed by Northern California Wildfire - ABC News http://t.co/YmY4rSkQ3d']
[1 1 1 ... 1 1 1]
```

In [8]:
```
#Model constant
max_features = 20000
embedding_dim = 128
max_len = 500
from keras.layers import*
vectorize_layer = TextVectorization(
    max_tokens=max_features,
    output_mode='int',
    output_sequence_length=max_len)
vectorize_layer.adapt(train_data)
import tensorflow as tf
def vectorize_text(text, label):
    text = tf.expand_dims(text, -1)
    return vectorize_layer(text), label
```

In [12]:
```
# Start to build bidirection LSTM model
from keras.metrics import AUC
from keras import optimizers, losses
def build_model():

    text_input = tf.keras.Input(shape=(1,), dtype=tf.string, name='text')
    x = vectorize_layer(text_input)
    x = Embedding(max_features + 1, embedding_dim)(x)
    x = Dropout(0.5)(x)

    x1 = Bidirectional(LSTM(units=128, return_sequences=True))(x)
    x2 = Bidirectional(LSTM(units=64, return_sequences=True))(x1)

    z2 = Bidirectional(GRU(units=128, return_sequences=True))(x)
    z3 = Bidirectional(GRU(units=64, return_sequences=True))(z2)
    c = Concatenate(axis=2)([x2, z3])

    x3 = Bidirectional(LSTM(units=128, return_sequences=True))(c)
    # Conv1D + global max pooling

    x = GlobalMaxPooling1D()(x3)

    # We add a vanilla hidden layer:
    x = Dense(128, activation="relu")(x)
    x = Dropout(0.5)(x)

    # We project onto a single unit output layer, and squash it with a sigmoid:
    predictions = Dense(1, activation="sigmoid", name="predictions")(x)

    model = tf.keras.Model(text_input, predictions)

    # Compile the model with binary crossentropy loss and an adam optimizer.

    model.compile(loss=losses.binary_crossentropy, optimizer=optimizers.rmsprop_v2.RMSprop(learning_rate=0.01)
    #model.compile(loss=losses.binary_crossentropy, optimizer=optimizers.rmsprop_v2.RMSprop(learning_rate=0.0)
    return model
```

In [13]:
```
model = build_model()
model.summary()
```

```
Model: "model"
_________________________________________________________________
 Layer (type)                Output Shape              Param #   Connected to
=================================================================================================
 text (InputLayer)           [(None, 1)]               0         []

 text_vectorization (TextVectorization)  (None, 50)    0         ['text[0][0]']

 embedding (Embedding)       (None, 50, 128)           2560128   ['text_vectorization[0][0]']

 dropout (Dropout)           (None, 50, 128)           0         ['embedding[0][0]']

 bidirectional (Bidirectional)  (None, 50, 256)        263168    ['dropout[0][0]']

 bidirectional_2 (Bidirectional)  (None, 50, 256)      198144    ['dropout[0][0]']

 bidirectional_1 (Bidirectional)  (None, 50, 128)      164352    ['bidirectional[0][0]']

 bidirectional_3 (Bidirectional)  (None, 50, 128)      123648    ['bidirectional_2[0][0]']

 concatenate (Concatenate)   (None, 50, 256)           0         ['bidirectional_1[0][0]',
                                                                  'bidirectional_3[0][0]']

 bidirectional_4 (Bidirectional)  (None, 50, 256)      394240    ['concatenate[0][0]']

 global_max_pooling1d (GlobalMaxPooling1D)  (None, 256)  0      ['bidirectional_4[0][0]']

 dense (Dense)               (None, 128)               32896     ['global_max_pooling1d[0][0]']

 dropout_1 (Dropout)         (None, 128)               0         ['dense[0][0]']

 predictions (Dense)         (None, 1)                 129       ['dropout_1[0][0]']

=================================================================================================
Total params: 3,736,705
Trainable params: 3,736,705
Non-trainable params: 0
_________________________________________________________________
```

In [14]:
```
#Split the training set into 2 part, train and valid
from sklearn.model_selection import train_test_split
x_train, x_valid, y_train, y_valid = train_test_split(x_train, y_train, test_size=0.2, random_state=1)
```

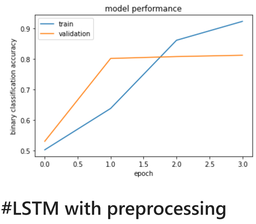
In [15]:
```
from keras.callbacks import *

lr = ReduceLROnPlateau(monitor="val_auc", mode='max', factor=0.7, patience=4, verbose=False)
es = EarlyStopping(monitor='val_auc',mode='max', patience=10, verbose=False,restore_best_weights=True)

history = model.fit(x_train, y_train, validation_data=(x_valid, y_valid), epochs=4, batch_size=256,
                    callbacks=[es,lr])
```

```
Epoch 1/4
24/24 [==============================] - 114s 4s/step - loss: 1.1843 - auc: 0.5026 - val_loss: 0.6870 - val_au
c: 0.5305 - lr: 0.0100
Epoch 2/4
24/24 [==============================] - 76s 3s/step - loss: 0.6593 - auc: 0.6383 - val_loss: 0.5318 - val_au
c: 0.8024 - lr: 0.0100
Epoch 3/4
24/24 [==============================] - 75s 3s/step - loss: 0.4565 - auc: 0.8620 - val_loss: 0.5612 - val_au
c: 0.8085 - lr: 0.0100
Epoch 4/4
24/24 [==============================] - 79s 3s/step - loss: 0.3396 - auc: 0.9240 - val_loss: 0.6868 - val_au
c: 0.8129 - lr: 0.0100
```

In [17]:
```
#Plot the performance
def plot_hist(hist, metric='auc'):
    plt.plot(hist.history[metric])
    plt.plot(hist.history["val_" + metric])
    plt.title(f"model performance")
    plt.ylabel("binary classification accuracy")
    plt.xlabel("epoch")
    plt.legend(["train", "validation"], loc="upper left")
    plt.show()
    return
plot_hist(hist=history)
```



#LSTM with preprocessing

In [1]:

```python
import pandas as pd
import numpy as np
import torch
from torch import cuda
import random
import os
import re
import torch
from torch import nn
from collections import Counter
from sklearn.model_selection import train_test_split
from sklearn.metrics import f1_score, classification_report
from sklearn.utils.class_weight import compute_class_weight
from matplotlib import pyplot as plt
print(torch.__version__)
```

```
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In [4]:

```python
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#Training_data
train_data = pd.read_csv(r"C:\Users\Sunny\Downloads\train.csv")
#test data import
test_data = pd.read_csv(r"C:\Users\Sunny\Downloads\test.csv")
```

In [5]:

```python
#Print out the columns name and remove the header
print(train_data.columns)
train_data.head(5)
```

```
Index(['id', 'keyword', 'location', 'text', 'target'], dtype='object')
```

Out[5]:

	id	keyword	location	text	target
0	1	NaN	NaN	Our Deeds are the Reason of this #earthquake M...	1
1	4	NaN	NaN	Forest fire near La Ronge Sask. Canada	1
2	5	NaN	NaN	All residents asked to 'shelter in place' are ...	1
3	6	NaN	NaN	13,000 people receive #wildfires evacuation or...	1
4	7	NaN	NaN	Just got sent this photo from Ruby #Alaska as ...	1

In [6]:

```python
#create Target
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y_train = train_label.reshape(-1)
train_data.drop(['id', 'keyword', 'location', 'target'], axis=1, inplace=True)
test_data.drop(['id', 'keyword', 'location'], axis=1, inplace=True)
train_data = train_data.to_numpy()
test_data = test_data.to_numpy()
x_train = train_data.reshape(-1)
x_test = test_data.reshape(-1)
print(x_train)
print(y_train)
```

```
['Our Deeds are the Reason of this #earthquake May ALLAH Forgive us all'
 'Forest fire near La Ronge Sask. Canada'
 "All residents asked to 'shelter in place' are being notified by officers. No other evacuation or shelter in place orders are expected"
 ... 'M1.94 [01:04 UTC]?5km S of Volcano Hawaii. http://t.co/zDtoyd8EbJ'
 'Police investigating after an e-bike collided with a car in Little Portugal. E-bike rider suffered serious non-life threatening injuries.'
 'The Latest: More Homes Razed by Northern California Wildfire - ABC News http://t.co/YmY4rSkQ3d']
[1 1 1 ... 1 1 1]
```

In [8]:

```python
#Data clearning
def clean_tweet(tweet):
  #remove apostrophe
  tweet = re.sub(r'\x89Ûª', "'", tweet)
  tweet = re.sub(r'\x89Û÷', "'", tweet)
  #remove quotation
  tweet = re.sub(r'\x89ÛÏ', '"', tweet)
  tweet = re.sub(r'\x89Û\x9d', '"', tweet)
  #remove hyphen
  tweet = re.sub(r'\x89ÛÒ', '-', tweet)
  tweet = re.sub(r'\x89ÛÓ', '—', tweet)
  #remove euro
  tweet = re.sub(r'\x89âÂ', '€', tweet)
  #remove ellipsis
  tweet = re.sub(r'\x89Û_', '...', tweet)
  #remove amp
  tweet = re.sub(r'&', 'and', tweet)
  #remove bullet
  tweet = re.sub(r"\x89Û¢åÊ", "", tweet)
  tweet = re.sub(r'\x89Û¢', '', tweet)
  #remove others
  tweet = re.sub(r"fromåÊwounds", "from wounds", tweet)
  tweet = re.sub(r"åÊ", "", tweet)
  tweet = re.sub(r"åÈ", "", tweet)
  tweet = re.sub(r"JapÌ_n", "Japan", tweet)
  tweet = re.sub(r"Ì©", "e", tweet)
  tweet = re.sub(r"å¨", "", tweet)
  tweet = re.sub(r"SuruÌ¤", "Suruc", tweet)
  tweet = re.sub(r"åÇ", "", tweet)
  tweet = re.sub(r"å£3million", "3 million ", tweet)
  tweet = re.sub(r"åÀ", "", tweet)
  return tweet
#remove URL
def remove_URL(text):
    url = re.compile(r'https?://\S+|www\.\S+')
    return url.sub(r'This is a website.',text)
#remove html
def remove_html(text):
  html=re.compile(r'<.*?>')
  return html.sub(r'',text)
#remove emoji
def remove_emoji(text):
    emoji_pattern = re.compile("["
                           u"\U0001F600-\U0001F64F"  # emoticons
                           u"\U0001F300-\U0001F5FF"  # symbols & pictographs
                           u"\U0001F680-\U0001F6FF"  # transport & map symbols
                           u"\U0001F1E0-\U0001F1FF"  # flags (iOS)
                           u"\U00002702-\U000027B0"
                           u"\U000024C2-\U0001F251"
                           "]+", flags=re.UNICODE)
    return emoji_pattern.sub(r'', text)
```

In [10]:

```python
#Normalization and printed
def custom_standardization(input_data):
    r = clean_tweet(input_data)
    r = remove_URL(r)
    r = remove_html(r)
    r = remove_emoji(r)
    r = str.lower(r)
    return r
all_tweets = np.append(x_train, x_test)
def normalization(tweets):
    result = []
    for tweet in tweets:
        result.append(custom_standardization(tweet))
    return result
all_tweets = normalization(all_tweets)
#Print out the text after data clearning and normalization
print(all_tweets)
```

is evil', "think of it as a reality tv show i tell myself to quell the panic rising in my chest.",
trapped in lobby, the 150-square-foot', 'been signed out of work for a week as i have a trapped nerve and can no
t move.\ life is a struggle right now.] ????', 'confused westie believes dogs are trapped in the computer\nthe
is a website.', 'this is a website.', '#teambriannamullah]', "no one on the south shore knows how to make go
le: 'the 33' hollywood movie about trapped miners released in chi... this is a website.', '#teambrian
ond coldren and i'm trapped in a living hell', 'then #alteprotic on this trapped out evil mansion\n\nthis is a w
ebsite.', 'eric is 18 trapped in a 48 year olds buddy', 'hollywood movie about trapped miners released in chil
e: "the 33" hollywood movie about trapped mine... this is a website.', '#captories', 'took her to the trap house
now (is) mama trapped on ???', 'if i ever saw a dog trapped in a hot car with the windows up i'd be smashing the
ucking windows open and taking your dog', 'hollywood movie about trapped miners released in chile: santiago ch
ile (ap) - the hollywood movie on the 33 m... this is a website.', 'billionaire mexican trying getting trapped mon
ey out of venezuela - bloomberg this is a website.', '#pandamonium duly noted.the involuntary wince i have w
hen people send me words like "lolibobs" must make it look like i have some form of palsy/ tic.', "this lady went in hosp
ital after he broke his leg trapped in cave in press more this is a website.', "it's a trap
p not a fucking game. u ain't trapping if u ain't trap: 'i feel trapped by circumstances', 'ghost is literally not
learning about new places and the freedom to not be trapped in one place forever.', 'students who have been sur
rounded by people who are trapped mentally. emails from the jobs', 'as a website.', 'it's a trap", 'children trap
like divorce violence andamp; poverty - often act out... this is a website.', 'it's a trap
e.', 'rt emm austin: wow #marijuana is critical for research in treating #ptsd\n\nthis is a website. \n#hempoil
l #cann... this is a website.', "mickmundi rt ocjfc] rocjfc] president judge byrne opens the first pa-?lt sum
it on #trauma andamp; the courts in #cleve... this is a website.', "it's hard learned about the pain through
rough piggy and kermit this is a website.', 'esteemed journalist recalls tragic effects of unaddressed #child
ood #trauma. #counseling #therapy #newauthors #hiv this is a website.', 'it's a website.', 'my brain is mutely ite
itself from such terrible trauma', 'effective immediately meaning i don't feel like this can respond as a level 2
pediatric trauma center. this is a website.', '#mountainairyou #beingtweets #susancarevick #onbeingawhitetrial
pgets this is important for women living w/hiv the silence of trauma', 'having ... told me to paint my st
ory eighty-nine year old man recalls the terror and the trauma when the... this is a website.', "idk how i'm
supposed to have my daughter in gymnastics and cheerleading... ugh diva
??', "Bangastattack dating a woman does not make you a lesbian... however lesbians are in fact focused by expe
ning trauma involving a man", "why #marijuana is critical for research in treating #ptsd this is a website.' #
e. \n#hempoil #cannabis #marijuananews this is a website.', 'your brain is particularly vulnerable to trauma at
t two distinct apes this is a website.', 'your brain is particularly vulnerable to trauma at two distinct ages
this is a website. via @gt', 'gutted. 6 weeks to go to get a major trauma'
e specialist tomorrow #gcc #sagarak this is a website.', 'your brain is particularly vulnerable to trauma at tw
o distinct apes this is a website.', 'north american research report on trauma', 'cancer', 'nyrhx in the shock...
ipoh : this is a website. this is a website.', 'pts... the 8 traumatised after mass killing in 2', 'traumatised tea
chers in 1922 by a poet wwl inquiry this is a website.', "i've spent my life traumatised... everyone...
that we couldn't beieve me. but i do a recap in a pool and i'm dead", 'my mom's friend is so traumatised...
is gonna be like traumatized forever i think lol', 'i'm not kidding... the pole', i'm just...
ing to believe nonsense - you own your thinking andamp; stop... blaming a ... i've been...
hrwright too traumatized to ask why...,', "#ibxatum... sorry you see my traumatised...
xcuse the typos!", "#titusoreily he's not responsible for... traumatised the fifth... sa...
od pile. pulling pieces out and i get a small bias ... "#trouble"', "i hate being in trouble...
ozzy: stalled bus at eda service road cubao sb due to mechanical trouble. 1 lane occupied. mmda
t/c on site.\n ... ", "a room full of adults going "hasn't scored... one could do trouble...
om pit's shitty mill of prepare for trouble". 'rt i... of trouble', etc.
mechanical trouble as of 7:15 am. 1 lane occupied... this is a website.', 'it is a righteous thin
g with god to repay with tribulation those who trouble you - 2 thessalonians', "must black folks don't wanna
xdir rp trouble .. which in turn causes them to be silent in the injustice of the wild, this is a website.'
"if all men sauntered like fred i think i'd be in trouble.", '#thailandexkeets #bullyinyourplantfires', 'i added a
otos: 22 year old yahoo boy in trouble for attempting to steal... this is a website.', '#mouth...
tting in my room the whole time in vegas to stay out of trouble', 'i'm not sorry i'm being... "this is
having some trouble with your site- keep getting the error page when placing an order', 'i'm happy my on...
the trouble in one of buffett's favorite sectors this is a website.', 'i'm thinking...
wo are in the building laughs and trouble haha.. great', 'bringing back trouble #hehm", "rt @fox...
bnews the trouble with reddit's content policy update this is a website.', 'i'm in so much trouble already
ing while listening to kian singing omg', 'today we just drove around fucking with tourists. we found an
ld guy and pretended we didn't speak english to him. took this one', "#sum t... seeeeen lots tsunami...
utube video from #teamSephinary this is a website. gem and our... "#kylewatch" vs. lol sorry for the toot
tog", "andy johnny tsunami commercial", 'i just want to have tsunami and... tsunami dtp toots ... me
tsunami. ?????', "#maldyhacks: rt illusionimagese: a 5 foot tsunami ... not talking people i'm
ndamp; #thanks beloved sister terri for rt of new video "the shoah meets ground zero: dirty bomb, 9/11
e andamp; tsunami", "@dacnlambau thx for your great book", "the world's... #ships: in 3... its a w
he coming apocalyptic as earthquake andamp; tsunami", "how did ordering a tsunami as the...
ou placed your order when you were on your way ????', 'tsunami with lots of ... and a smoothie please
nic : yes it but like wasnt", "oh it's a soccer ball.", "love tsunami this is a website.', "i li
ked a @youtube video this is a website. call of duty: ghosts of the... ??? the lapse in t
his two will. daru.. #attacatk', "#tagTiplays #twitter... a bedtime story or a twitter storm... the
sorry what you say theres a tweet tsunami happening right now', 'if you had a suitcase you had to take wit
uring a tsunami. what would you pack in it? this is a website.', 'photos from japan... on the 4 year anniv
time of the japanese earthquake and pacific tsunami this is a website.', 'the new guy, ... by the lot
pan", "how many more would a person parse if a parsing person could parse?" tongue twister', "twister wh
igious woodchucks", 'twister hits 4 villages in guarania this is a website.', 'we broke the... tho
k boxes', "#ElisjIlliss it's such a tongue twister", 'talking to this girl is... up to the
ing that good life on rocket power.', "playing twister with the whole family. the best family... i'm
e recently", "when you get stuck on the wicked twister", 'twister wreaked havoc... sure', 'this
is a website.', "#kayip i would pay to watch the lead in twister", "this is a website.", '#sweetwater
ong i'm to blame by #simpcommusic is about to play on 10.9 the twister! this is a website.', "rockerwelcomed a
ick twister that happened today this is a website.', 'rounds of a twister is the hardest tongue twister'
(try saying it five times fast).', "struggling to rise ... worst in japan... the big dream... 1945 has ki
led thousands. this is a website. this is a website.', 'this is a website.', '#hope4japan #pray4ja
obama signs disaster declaration for northern marianas a website', 'typhoon soudelor is like on its pre
dicted path as it approaches taiwan: expected to make landfall on southern china... 'this is a website.',
'obama sign disaster declaration for northern marianas a website', 'typhoon soudelor's ... website.
"typhoon soudelor heads for taiwan this is a website.', 'officials predicts... the powerful typhoon... images
s of asian super typhoon soudelor to cause violent impact as it ... ', 'what a photo: satellite views of the
ical spectacular satellite view of typhoon soudelor this is a website', '#photos: typhoon soudelor ... ja
pan has no water electricity in typhoon aftermath this is a website. this is a website.', 'photos from
., 'striking views of super typhoon soudelor as it approaches taiwan and china this is a website.', '#pra
an no water electricity in aftermath of typhoon this is a website.', 'the usa and flash in typhoon-deva
stated saipan: obama signs disaster declaration for northern marianas this is a website.', 'obama decl
laces disaster for typhoon-devastated saipan this is a website. the ... a cold war...',
background check of the child's details are done before the kids... an ab... 'i'm
hercy tinberng facilities upheaval entryearthq? fjizz...', 'i was upheaval... its a social... the pe
upheaval and change to fulfill the wishes of the people', 'i wish i could... have' 'this is a
great upheaval in my life and it's very odd that my cat... the... it being... the past
"bat four reasons en route to upheaval versus interference...", '#upheaval...
mayan tablet with hieroglyphics honors lowly king #news #arts', 'upheaval... this is a website.', ...
ite conspiracy up-to-the-minute upheaval: gwkd', 'for over... this is a ...', 'my s...
rhage of a show) #abcnetwork #abcnadarimes #eliompom', 'this is a website.', '#ancient
n sense of security. being with a person you can't trust is... upheaval... you and a
eval upheaval (hardy boys: the secret files)\nfranklin w. dixon', 'this is a website.', ...
received the sad news of our friends daughters cancer... the ... a website. this is a website.
n is a website.', 'this how retailers intend to support the ... #upheaval...', 'ohm'
is a website.', "@rogurkifala's reporting august 4 1945 this is a website.', 'violent... fabricating new
d andamp; sports upheaval now! was news', 'dramatic video shows... the chaotic... violent ...
ite.', "Philippines if the word 'violent' comes to mind... violent ... storm", "h
storm about 24 hours.   :(", "and kolkata is struck by a storm... this is ...
g. heavy rains and a violent storm approaching. god be with us", 'violent storm ... 'this is a ...
bried violent storm swept through the chicago area', '#thedm... storm ... chicago ...
raptures violent lashing from loose sandbags on the ...', 'violent storm... nearly ...
ue work on the top floor of a hotel when suddenly a violent storm...', 'this is a website.',
this is a website.', "rt @nalgarysaurus: sun photograph of a violent storm ... 3.1 violent storm this is a website.", '
torm in sylvan lake. #abstorm this is a website.", 'violent storm ... this is a website.', '
landing during violent storm this is a website.', 'violent storm ... "ill...
unein player 8 this is a website.', 'circus tent collapses in violent storm ... in
is a website.', 'storm in here! violent winds and driving rain', 'this is a website.', ...
next little while miles. we're having a bit of a violent storm ... 'this is a website.',
deadly accident at new hampshire circus this is a website.', 'violent storm...
ue playing aamppresszor - psalm before the storm\ntune in ...', 'this is ...
d be nice if they would fix radar before another violent storm ... this is a website.', '
r', '2015#health 250-foot-tall drilling rig broke in violent storm this is a website.', 'if ...
olent winds from #incomingtent #hmellmo", "this is a website.', 'volcano ...
ed white 3m a gel grey volcano.?', "force factor volcano ... this is a website.', '
website. this is a website.', "the sunset looked like a volcano... #hoodie ...
ar whenst java this is a website.", "#catholicmoura on volcano ...
he highlight of my day has been playing with my raw volcano ...
sunrise #seesaw0? the illuminati the yellowstone supervolcano ... 'this is a website.'
a volcano", "? keep volcano centre keep pass ?", 'this is a website.', ...
ophic eruption - the new yorker this is a website.', 'm1.9 - 5km s of volcano hawaii: time2015-08-05 0
1:04:01 utc2015-08-05 15:04:01 -10:00 at epicenter...', 'this is a website.', ...
tion) 2015 ?? by qj volcano a start team\n\ndownload ...', 'm1.9 ... volcano ha
wali: time2015-08-05 01:04:01 utc2015-08-05 15:04:01 -10:00 ...
1.9 - 5km s of volcano hawaii', "what's the hottest ... volcano ...
big? this is a website.", "the architect behind kanye west's volcano ... this is a website.', 'jus
st watched punisher: war zone. idk why everyone hates it ... 'this is a website.', ...
t out of punisher.", 'my new sounds: war zone this is a website.', ...
ne. jamal spoke to me on the phone. now my wife is n... war zone', 'this is a website.', ...
e.', "#thelovelyoscar omg i feel like i am in a war zone", 'this is a website.', ...
ore i tackle the war zone that is is my bedroom. i w... war zone ...
e a war zone though', "i think 810 male or female g... war zone ...
ngle will be... this is a website.", "um ok "@dandre... war zone ...
women shouldn't even ilny cond it as a war zone"", 'complete war zone ...
'twitter is going to be a war zone today this is a website.', ...
 tps forces in the red zone the war-torn outskirts ... this is a website.', ...
ed and you running out of weapon options ?????? #tea... weapon ...
ars in 212 seconds' level 43 surgeon. weapon of choice ... this is a website.', ...
changed his weapon into a gun. "the weapons of mass destruction ...
the beep me weapon and battle how did he do that!", ...
counter to the slasher and the splatting", 'islahe... weapon ...
pon.\nwe need the world of peace. one that is a wonderful ... weapon ...
ter is my weapon. you're either screwed or you ... weapon ...
most powerful weapon. (#vickyamoumbere) #spoken ... 'this is a website.', ...
 rivercaster7 #hiroshima bomb it is important to learn ... weapon ...
the ones but the class of weapon', "#sindy#24898 \ ...
truely connected.\nI want truely connected world ... weapon ...
1 give him the benefit of the doubt this year. i'm j... weapon ...
yopo #youtube its engineer only again so 2 1000+ sp... weapon ...
id this is a website.", "i'm all in favor of keeping ... weapon ...
with typewriters.", "security experts report that t... weapons ...
clear weapons in by... this is a website.", "aug 3 1... weapons ...
re's weapons -- excel with bayonet.\nthis is a website.', ...
free rent free food.free weapons license to kill and ... weapons ...
n \n   bywnrlnbring your own weapons", 'ah', 'she prop... weapons ...
hiv defense minister made clear nukes are fine. this is a website.', ...
defense during oneo rhattanooga terrorist attack with weapons ... this is a website.', ...
o well weapons to #nigeria is an attempt to upgrade ... weapons ...
l of bombarded kuala.", "#hazrcolbygreat what a whirlwind ... this is a website.', ...
ppen, whats it really called?', ... whirlwind ... this is a website.', ...
phy dead, 'its a whirlwind ... this is a website.', ...
ing... the most ... wild fires ... this is a website.', ...
wildfire ... this is a website.', ... wild fires ... this is a website.', ...
... wildfires ... this is a website.', ... this is a website.', ...
... windstorm ... this is a website.', ... this is a website.', ...
... wounded ... this is a website.', ... this is a website.', ...
... wreck ... this is a website.', ... this is a website.', ...
... wreckage ... 'wreckage "conclusively confirmed" as from mh370 ... this is a website.', ...
... 'wrecked ... this is a website.', ... this is a website.', ...
of hurting anymore', 'when and how does a character recover from wounds? this is a website.', 'what they iden
tists don't tell u is how much ur mouth will be in pain when the numbing wears off because of the puncture wo
unds in ur gums.", "our wounds can so easily turn us into people we don't want to be and we hardly see it happ
ening", "i'm sitting in the parking lot waiting to go to therapy and i'm crying and an emotional wreck and i
don't want my therapist to know ??????????", 'last week we had a blast hosting dinner andamp; a movie night
with "wreck-it ralph" on #8tcaresmpac! #caresoner #get my music in my central car i can take a night drive to nowhere tonight. hopefully without a wreck.", "i'm
way this is a website.', '#dukexkywalker #facialabuse interesting in watching a train wreck while taking acid kind of
p: #ijasoldonesum] (ultimate throat generator) to a wreck off.', 'man faces manslaughter charges following fat
al sunday wreck | al.c... related articles: this is a website.', "is a wreck," 'gives ppl lifestyle advice",
"i'm an emotional wreck someone hold me until they upload the damn video #whatsthenpmtartvideo", 'i added a
video to a #youtube playlist this is a website. burn black - nervous wreck', 'and not a wreck of uneven laye
rs this is a website.', "wreckage "conclusively confirmed" as from mh370: malaysia pm: investigators and the
families of those who were... this is a website.', "wreckage "conclusively confirmed" as from mh370: malaysia pm
: investigators and the families of those who were... this is a website.', "wreckage "conclusively confirmed"
been confirmed on reunion island is it possible t... this is a website.', "wreckage "conclusively confirmed"
the families of those who were... this is a website.', "wreckage "conclusively confirmed" as from mh3
rmed" as from mh370: malaysia pm this is a website.', "#rt @australian debr
is found on an indian ocean island confirmed to be from flight #mh370. this is a website.', "cramer: iger's 3
words that wrecked disney's stock this is a website.', "almost "wrecked" my van the other day because of this
guy (yeah i brake andamp; also care for animals - got to get used to it)', 'this is a website.', "what manner of ma
an being would parade out a baby as though it were a wrecked car in a junk yard? the...' - dtom2 this is a web
site.", "hnathan25_rfc thought you said saturday night there were a wreck in my van i can't wait to... 'i just
wanna make your mind and make you feel alright.????', "#ysbboob the... i had a wreck in my shoes... there a
re some side after texco wrecked him lol", "rt robo ... #dolla: "'3 words from disney ceo bob iger wrecked disney's stock a
ys jim cramer: this is a website. this is a website.', "wreckage "conclusively confirmed" as from mh3
70: malaysia pm: investigators and the families of those who were... this is a website.', "#ebola #ebolaoutbre
ak ebola virus: birmingham ala. firefighters quarantined after possible exposure officials say this is a websi
te.", 'malaysian pm confirms debris is from missing flight mh370 this is a website.', 'officials: alabama home
quarantined over possible ebola case - washington times', 'see the 16yr old pkk suicide bomber who detonated
bomb in turkey army trench released: harun lkekdar', '#hazrcolbygreat ... to conference attendee
s! the blue line from the airport has derailed - please look into taking a taxi to the hotel! see you soon!',
'the death toll in a #is-suicide car bombing on a #ypg position in the village of rajman in the eastern provi
nce of hasaka has risen to 9', "earthquake safety los angeles - safety fasteners xrwn", 'storm in ri worse tha
n last hurricane. my city&3others hardest hit. my yard looks like it was bombed. around 20000k still wit
hout power', "green line derailment in chicago this is a website.', 'meg issues hazardous weather outlook (hw
o) this is a website.', "#cityofcalgary has activated its municipal emergency plan. #yycstorm']

In [35]:

```python
#Model constant
max_features = 20000
embedding_dim = 128
max_len = 500
#TextVectorization
from keras.layers import*
vectorize_layer = TextVectorization(
    max_tokens=max_features,
    output_mode='int',
    output_sequence_length=max_len)
#Make a text-only dataset (no labels)
vectorize_layer.adapt(all_tweets)
#import tensorflow
import tensorflow as tf
def vectorize_text(text, label):
    text = tf.expand_dims(text, -1)
    return vectorize_layer(text), label
```

In [36]:

```python
# Start to build Bidirection LSTM model
from keras.metrics import AUC
from keras import optimizers, losses
def build_model():

    text_input = tf.keras.Input(shape=(1,), dtype=tf.string, name='text')
    x = vectorize_layer(text_input)
    x = Embedding(max_features + 1, embedding_dim)(x)
    x = Dropout(0.5)(x)
    #Bidirection LSTM
    x1 = Bidirectional(LSTM(units=128, return_sequences=True))(x)
    x2 = Bidirectional(LSTM(units=64, return_sequences=True))(x1)
    #GRU
    x2 = Bidirectional(GRU(units=128, return_sequences=True))(x)
    c3 = Bidirectional(GRU(units=64, return_sequences=True))(x2)
    c = Concatenate(axis=2)([x1, c3])
    x3 = Bidirectional(LSTM(units=128, return_sequences=True))(c)
    #Using Global Maxpooling
    x = GlobalMaxPooling1D()(x3)
    # Add a vanilla hidden layer:
    x = Dense(128, activation="relu")(x)
    x = Dropout(0.5)(x)
    # We project onto a single unit output layer, and squash it with a sigmoid:
    predictions = Dense(1, activation="sigmoid", name="predictions")(x)
    model = tf.keras.Model(text_input, predictions)
    # Compile the model with binary crossentropy loss and an adam optimizer.
    model.compile(loss=losses.binary_crossentropy, optimizer=optimizers.rmsprop_v2.RMSprop(learning_rate=0.01))
    return model
```

In [37]:

```python
model = build_model()
model.summary()
```

Model: "model_2"

Layer (type)	Output Shape	Param #	Connected to
text (InputLayer)	[(None, 1)]	0	[]
text_vectorization_3 (TextVectorization)	(None, 500)	0	['text[0][0]']
embedding_2 (Embedding)	(None, 500, 128)	2560128	['text_vectorization_3[0][0]']
dropout_4 (Dropout)	(None, 500, 128)	0	['embedding_2[0][0]']
bidirectional_10 (Bidirectional)	(None, 500, 256)	263168	['dropout_4[0][0]']
bidirectional_12 (Bidirectional)	(None, 500, 256)	198144	['dropout_4[0][0]']
bidirectional_11 (Bidirectional)	(None, 500, 128)	164352	['bidirectional_10[0][0]']
bidirectional_13 (Bidirectional)	(None, 500, 128)	123648	['bidirectional_12[0][0]']
concatenate_2 (Concatenate)	(None, 500, 256)	0	['bidirectional_11[0][0]', 'bidirectional_13[0][0]']
bidirectional_14 (Bidirectional)	(None, 500, 256)	394240	['concatenate_2[0][0]']
global_max_pooling1d_2 (GlobalMaxPooling1D)	(None, 256)	0	['bidirectional_14[0][0]']
dense_2 (Dense)	(None, 128)	32896	['global_max_pooling1d_2[0][0]']
dropout_5 (Dropout)	(None, 128)	0	['dense_2[0][0]']
predictions (Dense)	(None, 1)	129	['dropout_5[0][0]']

Total params: 3,736,705
Trainable params: 3,736,705
Non-trainable params: 0

In [38]:

```python
#Split the training set into 2 part, train and valid
from sklearn.model_selection import train_test_split
x_train, x_valid, y_train, y_valid = train_test_split(x_train, y_train, test_size=0.2, random_state=1)
```

In [39]:

```python
from keras.callbacks import *

lr = ReduceLROnPlateau(monitor="val_auc", mode='max', factor=0.7, patience=4, verbose=False)
es = EarlyStopping(monitor='val_auc',mode='max', patience=10, verbose=False,restore_best_weights=True)

history = model.fit(x_train, y_train, validation_data=(x_valid, y_valid), epochs=4, batch_size=256,
                    callbacks=[es,lr])
```

```
Epoch 1/4
24/24 [==============================] - 31s 708ms/step - loss: 1.3735 - auc: 0.4952 - val_loss: 0.6812 - val_
auc: 0.5000 - lr: 0.0100
Epoch 2/4
24/24 [==============================] - 14s 582ms/step - loss: 0.6880 - auc: 0.4949 - val_loss: 0.6830 - val_
auc: 0.5191 - lr: 0.0100
Epoch 3/4
24/24 [==============================] - 14s 589ms/step - loss: 0.6565 - auc: 0.6481 - val_loss: 0.6216 - val_
auc: 0.7209 - lr: 0.0100
Epoch 4/4
24/24 [==============================] - 14s 570ms/step - loss: 0.4735 - auc: 0.8393 - val_loss: 0.5404 - val_
auc: 0.7919 - lr: 0.0100
```

In [40]:

```python
#visualization of the result
def plot_hist(hist,metric):
    plt.plot(hist.history[metric])
    plt.plot(hist.history["val_" + metric])
    plt.title("model performance")
    plt.ylabel("binary classification accuracy")
    plt.xlabel("epoch")
    plt.legend(["train", "validation"], loc="upper left")
    plt.show()
    return
plot_hist(hist=history)
```