

Classification des images histopathologiques de cancer:Using DeepLearning CNN

Réaliser par:

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Dataset

Le cancer du sein est la forme la plus courante de cancer chez les femmes, et le carcinome canalaire invasif (IDC) est la forme la plus courante de cancer du sein. L'identification et la catégorisation précises des sous-types de cancer du sein est une tâche clinique importante, et des méthodes automatisées peuvent être utilisées pour gagner du temps et réduire les erreurs.

1. Install the Kaggle library

```
1 ! pip install -q kaggle
```

```
1 from google.colab import files  
2 uploaded = files.upload()
```

6

3. Make a directory named kaggle

```
1 ! mkdir ~/.kaggle
```

4. Copy the "kaggle.json" into this new directory

```
1 ! cp kaggle.json ~/.kaggle/
2
```

- ▼ 5. Allocate the required permission for this file.

```
1 ! chmod 600 ~/.kaggle/kaggle.json
```

- ▼ 6-Download datasets

```
1 #downlod dataset
2 ! kaggle datasets download -d paultimothymooney/breast-histopathology-images
```

```

Downloading breast-histopathology-images.zip to /content
100% 3.10G/3.10G [00:49<00:00, 96.7MB/s]
100% 3.10G/3.10G [00:49<00:00, 67.6MB/s]

```

- 7-Extract the data:

```
1 ! unzip breast-histopathology-images.zip -d breast_cancer_images
```

Le flux de sortie a été tronqué et ne contient que les 5000 dernières lignes.

[illegible]

```

inflating: breast_cancer_images/IDC_regular_ps50_idx5/9346/0/9346_idx5_x2401_
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```

```

1 import pandas as pd
2 import numpy as np
3 import os
4 from glob import glob
5 import random
6 import matplotlib.pyplot as plt
7 import keras.backend as K
8 from sklearn.model_selection import train_test_split
9 import tensorflow as tf
10 import keras
11 from keras.utils.np_utils import to_categorical
12 from keras.models import Sequential
13 from keras.layers import Dense, Dropout, Activation, Flatten, Conv2D, MaxPool2D, Max
14 %matplotlib inline

```

```

1 try:
2     tpu = tf.distribute.cluster_resolver.TPUClusterResolver()
3     print('Running on TPU ', tpu.master())
4 except ValueError:
5     tpu = None
6
7 if tpu:
8     tf.config.experimental_connect_to_cluster(tpu)
9     tf.tpu.experimental.initialize_tpu_system(tpu)

```

[illegible]

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```

9
10 random.seed(98)
11 np.random.seed(98)

1 breast_img = glob.glob('/breast-histopathology-images/IDC_regular_ps50_idx5/**/*.png')
2
3 for imgname in breast_img[:3]:
4     print(imgname)
5

1 imagePatches = glob.glob("breast_cancer_images/**/*.png", recursive=True)
2 for filename in imagePatches[0:10]:
3     print(filename)
4

breast_cancer_images/13458/0/13458_idx5_x851_y1001_class0.png
breast_cancer_images/13458/0/13458_idx5_x801_y1001_class0.png
breast_cancer_images/13458/0/13458_idx5_x151_y1001_class0.png
breast_cancer_images/13458/0/13458_idx5_x1101_y1351_class0.png
breast_cancer_images/13458/0/13458_idx5_x1301_y1351_class0.png
breast_cancer_images/13458/0/13458_idx5_x501_y1051_class0.png
breast_cancer_images/13458/0/13458_idx5_x251_y851_class0.png
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breast_cancer_images/13458/0/13458_idx5_x1101_y1201_class0.png
breast_cancer_images/13458/0/13458_idx5_x1301_y1401_class0.png

1 non_img = []
2 can_img = []
3
4 for img in imagePatches:
5     if img[-5] == '0' :
6         non_img.append(img)
7
8     elif img[-5] == '1' :
9         can_img.append(img)

1 non_num = len(non_img)
2 can_num = len(can_img)
3
4 total_img_num = non_num + can_num
5
6 print('Number of Images in IDC (-): {}'.format(non_num))
7 print('Number of Images in IDC (+) : {}'.format(can_num))
8 print('Total Number of Images : {}'.format(total_img_num))

Number of Images in IDC (-): 397476
Number of Images in IDC (+) : 157572
Total Number of Images : 555048

1 from keras.preprocessing import image

```

```
2
3 plt.figure(figsize = (15, 15))
4
5 some_non = np.random.randint(0, len(non_img), 18)
6 some_can = np.random.randint(0, len(can_img), 18)
7
8 s = 0
9 for num in some_non:
10
11     img = image.load_img((non_img[num]), target_size=(100, 100))
12     img = image.img_to_array(img)
13
14     plt.subplot(6, 6, 2*s+1)
15     plt.axis('off')
16     plt.title('IDC (-)')
17     plt.imshow(img.astype('uint8'))
18     s += 1
19
20 s = 1
21 for num in some_can:
22
23     img = image.load_img((can_img[num]), target_size=(100, 100))
24     img = image.img_to_array(img)
25
26     plt.subplot(6, 6, 2*s)
27     plt.axis('off')
28     plt.title('IDC (+)')
29     plt.imshow(img.astype('uint8'))
30     s += 1
```

```
1 from matplotlib.image import imread
2 import cv2
3
4 some_non_img = random.sample(non_img, len(can_img))
5 some_can_img = random.sample(can_img, len(can_img))
6
7 non_img_arr = []
8 can_img_arr = []
9
10 for img in some_non_img:
11
12     n_img = cv2.imread(img, cv2.IMREAD_COLOR)
13     n_img_size = cv2.resize(n_img, (50, 50), interpolation = cv2.INTER_LINEAR)
14     non_img_arr.append([n_img_size, 0])
15
16 for img in some_can_img:
17
18     c_img = cv2.imread(img, cv2.IMREAD_COLOR)
19     c_img_size = cv2.resize(c_img, (50, 50), interpolation = cv2.INTER_LINEAR)
20     can_img_arr.append([c_img_size, 1])
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```

9     y.append(label)
10
11 X = np.array(X)
12 y = np.array(y)
13
14 print('X shape : {}'.format(X.shape))

    X shape : (315144, 50, 50, 3)

1 from sklearn.model_selection import train_test_split
2 from keras.utils.np_utils import to_categorical
3
4 X_train, X_predict, y_train, y_true = train_test_split(X, y, test_size = 0.3, random
5
6 rate = 0.5
7 num = int(X.shape[0] * rate)
8
9 X_test = X_train[num:]
10 X_train = X_train[:num]
11
12 y_test = y_train[num:]
13 y_train = y_train[:num]
14
15 y_train = to_categorical(y_train, 2)
16 y_test = to_categorical(y_test, 2)
17 y_true = to_categorical(y_true, 2)
18
19 print('X_train shape : {}'.format(X_train.shape))
20 print('X_test shape : {}'.format(X_test.shape))
21 print('X_predict shape : {}'.format(X_predict.shape))
22 print('y_train shape : {}'.format(y_train.shape))
23 print('y_test shape : {}'.format(y_test.shape))
24 print('y_true shape : {}'.format(y_true.shape))

```

```

    X_train shape : (157572, 50, 50, 3)
    X_test shape : (63028, 50, 50, 3)
    X_predict shape : (94544, 50, 50, 3)
    y_train shape : (157572, 2)
    y_test shape : (63028, 2)
    y_true shape : (94544, 2)

```

```

1 from keras.models import Sequential
2 from keras.layers import Conv2D, MaxPooling2D, Dropout, Flatten, Dense
3
4 model = Sequential()
5
6 model.add(Conv2D(32, (3, 3), padding = 'same', activation = 'relu', input_shape = (5
7 model.add(MaxPooling2D(2, 2))
8 model.add(Dropout(0.25))
9
10 model.add(Conv2D(64, (3, 3), padding = 'same', activation = 'relu', input_shape = (5
11 model.add(MaxPooling2D(2, 2))

```



```

12 model.add(Dropout(0.25))
13
14 model.add(Conv2D(128, (3, 3), padding = 'same', activation = 'relu', input_shape = (
15 model.add(MaxPooling2D(2, 2))
16 model.add(Dropout(0.25))
17
18 model.add(Conv2D(128, (3, 3), padding = 'same', activation = 'relu', input_shape = (
19 model.add(MaxPooling2D(2, 2))
20 model.add(Dropout(0.25))
21
22 model.add(Flatten())
23 model.add(Dense(128, activation = 'relu'))
24
25 model.add(Dropout(0.5))
26 model.add(Dense(2, activation = 'sigmoid'))
27
28 model.summary()

```

Model: "sequential"

Layer (type)	Output Shape	Param #
=====		
conv2d (Conv2D)	(None, 50, 50, 32)	896
max_pooling2d (MaxPooling2D)	(None, 25, 25, 32)	0
dropout (Dropout)	(None, 25, 25, 32)	0
conv2d_1 (Conv2D)	(None, 25, 25, 64)	18496
max_pooling2d_1 (MaxPooling2D)	(None, 12, 12, 64)	0
dropout_1 (Dropout)	(None, 12, 12, 64)	0
conv2d_2 (Conv2D)	(None, 12, 12, 128)	73856
max_pooling2d_2 (MaxPooling2D)	(None, 6, 6, 128)	0
dropout_2 (Dropout)	(None, 6, 6, 128)	0
conv2d_3 (Conv2D)	(None, 6, 6, 128)	147584
max_pooling2d_3 (MaxPooling2D)	(None, 3, 3, 128)	0
dropout_3 (Dropout)	(None, 3, 3, 128)	0
flatten (Flatten)	(None, 1152)	0
dense (Dense)	(None, 128)	147584
dropout_4 (Dropout)	(None, 128)	0
dense_1 (Dense)	(None, 2)	258

```
=====
Total params: 388,674
Trainable params: 388,674
Non-trainable params: 0
=====
```

```
1 #from keras.optimizers import Adam
2 from tensorflow.keras.optimizers import Adam
3
4
5 Adam = Adam(learning_rate = 0.0001)
6 model.compile(loss = 'binary_crossentropy', optimizer = Adam, metrics = ['accuracy'])
```

```
1 history = model.fit(X_train, y_train, validation_data = (X_test, y_test), epochs = 15)
```

```
Epoch 1/15
3152/3152 [=====] - 127s 40ms/step - loss: 0.6002 - accu
Epoch 2/15
3152/3152 [=====] - 116s 37ms/step - loss: 0.3139 - accu
Epoch 3/15
3152/3152 [=====] - 115s 37ms/step - loss: 0.2935 - accu
Epoch 4/15
3152/3152 [=====] - 114s 36ms/step - loss: 0.2818 - accu
Epoch 5/15
3152/3152 [=====] - 115s 37ms/step - loss: 0.2728 - accu
Epoch 6/15
3152/3152 [=====] - 114s 36ms/step - loss: 0.2657 - accu
Epoch 7/15
3152/3152 [=====] - 115s 37ms/step - loss: 0.2611 - accu
Epoch 8/15
3152/3152 [=====] - 115s 37ms/step - loss: 0.2580 - accu
Epoch 9/15
3152/3152 [=====] - 113s 36ms/step - loss: 0.2545 - accu
Epoch 10/15
3152/3152 [=====] - 113s 36ms/step - loss: 0.2515 - accu
Epoch 11/15
3152/3152 [=====] - 114s 36ms/step - loss: 0.2485 - accu
Epoch 12/15
3152/3152 [=====] - 115s 37ms/step - loss: 0.2458 - accu
Epoch 13/15
3152/3152 [=====] - 114s 36ms/step - loss: 0.2433 - accu
Epoch 14/15
3152/3152 [=====] - 114s 36ms/step - loss: 0.2406 - accu
Epoch 15/15
3152/3152 [=====] - 113s 36ms/step - loss: 0.2385 - accu
```

```
1 model.save("model_TP.h5")
```

```
1 P = model.predict(X_predict)
2
3 true = 0
4 for i in range(X_predict.shape[0]):
5     if(np.argmax(P[i]) == np.argmax(y_true[i])):
```

```

6         true = true + 1
7
8 pre_accuracy = 100 * float(true/X_predict.shape[0])
9 print('Predict Accuracy: {}'.format(pre_accuracy))

```

Predict Accuracy: 90.53245049923845

```

1 result = model.evaluate(X_test, y_test, batch_size = 50)
2 print('Test Loss, Test Accuracy :', result)

```

1261/1261 [=====] - 19s 15ms/step - loss: 0.2761 - accuracy: 0.9058672189712524
 Test Loss, Test Accuracy : [0.2760542035102844, 0.9058672189712524]



```

1 plt.plot(history.history['accuracy'])
2 plt.plot(history.history['val_accuracy'])
3 plt.title('Model Accuracy')
4 plt.xlabel('epoch')
5 plt.ylabel('accuracy')
6 plt.legend(['train', 'test'], loc='upper left')
7 plt.show()

```

1

```

1 plt.plot(history.history['loss'])
2 plt.plot(history.history['val_loss'])
3 plt.title('Model Loss')
4 plt.xlabel('epoch')
5 plt.ylabel('loss')
6 plt.legend(['train', 'test'], loc='upper left')
7 plt.show()

```

