Implementación de CNN, COVID19

Universidad Nacional de San Agustín de Arequipa
Ciencia de la Computación

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Clasificación de pulmones con (Covid-Normales)

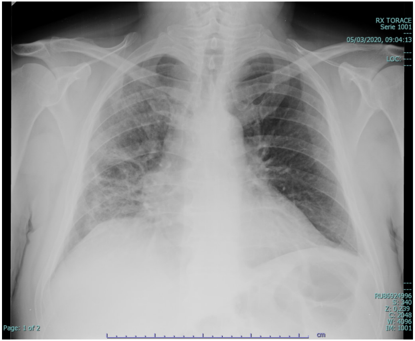


Figure: Con Covid

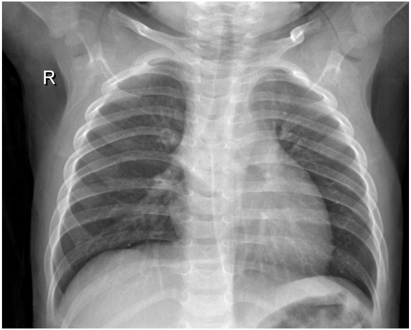


Figure: Normal

Librerías Usadas para construir el modelo

- Keras
- Tensorflow

Procesamiento de datos

Data set https://www.kaggle.com/nabeelsajid917/covid-19-x-ray-10000-images

- normal 28 imagenes
- covid 70 imagenes

InceptionV4

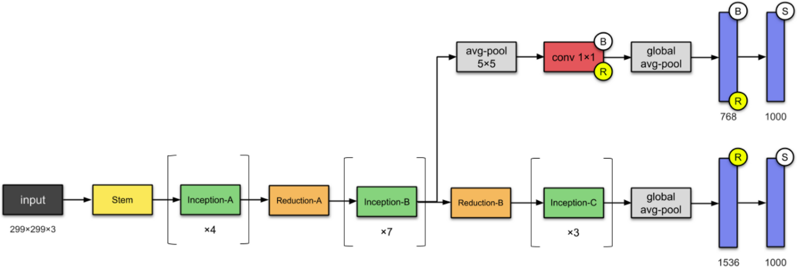


Figure: modelo general

Block Stem

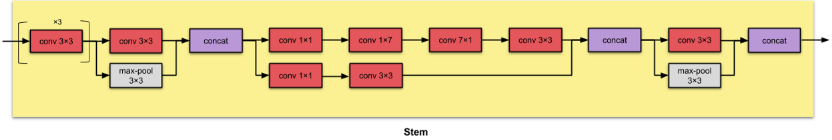
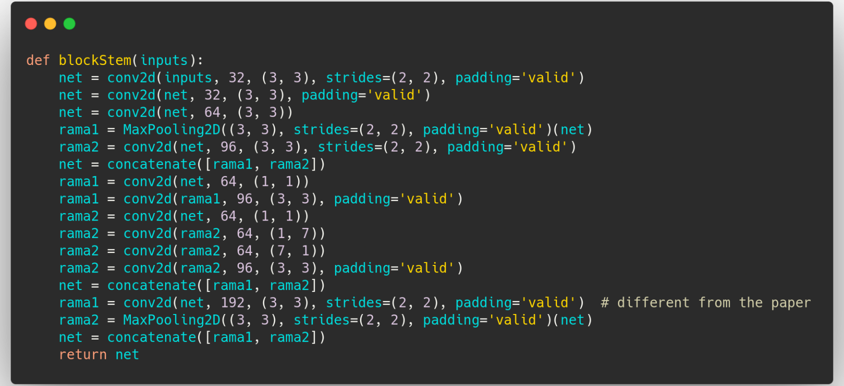


Figure: Stem

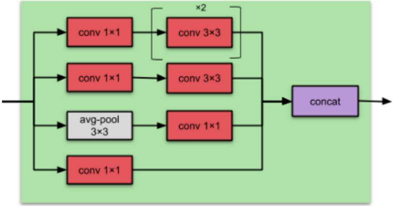
Block stem en keras



```
def blockStem(inputs):
    net = conv2d(inputs, 32, (3, 3), strides=(2, 2), padding='valid')
    net = conv2d(net, 32, (3, 3), padding='valid')
    net = conv2d(net, 64, (3, 3))
    rama1 = MaxPooling2D((3, 3), strides=(2, 2), padding='valid')(net)
    rama2 = conv2d(net, 96, (3, 3), strides=(2, 2), padding='valid')
    net = concatenate([rama1, rama2])
    rama1 = conv2d(net, 64, (1, 1))
    rama1 = conv2d(rama1, 96, (3, 3), padding='valid')
    rama2 = conv2d(net, 64, (1, 1))
    rama2 = conv2d(rama2, 64, (1, 7))
    rama2 = conv2d(rama2, 64, (7, 1))
    rama2 = conv2d(rama2, 96, (3, 3), padding='valid')
    net = concatenate([rama1, rama2])
    rama1 = conv2d(net, 192, (3, 3), strides=(2, 2), padding='valid')  # different from the paper
    rama2 = MaxPooling2D((3, 3), strides=(2, 2), padding='valid')(net)
    net = concatenate([rama1, rama2])
    return net
```

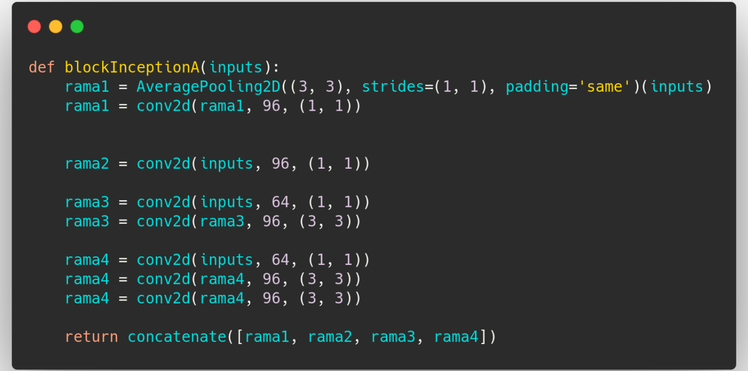
Figure: Implementación en keras

Block Inception A



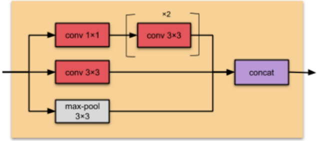
Inception-A

Block Inception A en keras



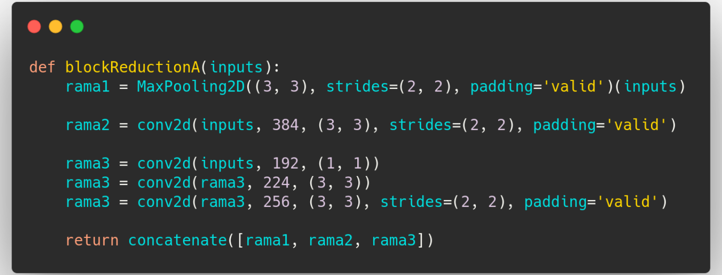
```python
def blockInceptionA(inputs):
    rama1 = AveragePooling2D((3, 3), strides=(1, 1), padding='same')(inputs)
    rama1 = conv2d(rama1, 96, (1, 1))


    rama2 = conv2d(inputs, 96, (1, 1))

    rama3 = conv2d(inputs, 64, (1, 1))
    rama3 = conv2d(rama3, 96, (3, 3))

    rama4 = conv2d(inputs, 64, (1, 1))
    rama4 = conv2d(rama4, 96, (3, 3))
    rama4 = conv2d(rama4, 96, (3, 3))

    return concatenate([rama1, rama2, rama3, rama4])
```

Block Reduction A



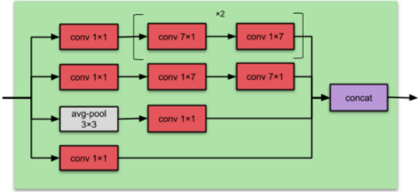
Reduction-A

Block Reduction A en keras



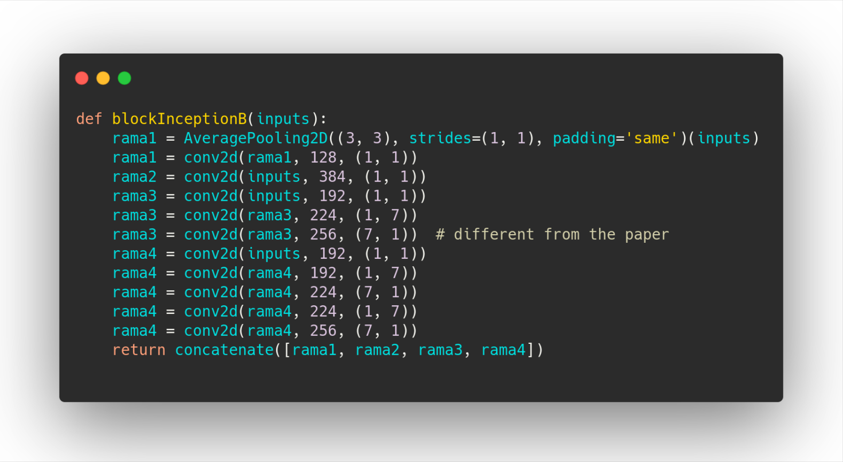
```python
def blockReductionA(inputs):
    rama1 = MaxPooling2D((3, 3), strides=(2, 2), padding='valid')(inputs)

    rama2 = conv2d(inputs, 384, (3, 3), strides=(2, 2), padding='valid')

    rama3 = conv2d(inputs, 192, (1, 1))
    rama3 = conv2d(rama3, 224, (3, 3))
    rama3 = conv2d(rama3, 256, (3, 3), strides=(2, 2), padding='valid')

    return concatenate([rama1, rama2, rama3])
```

Block Inception B



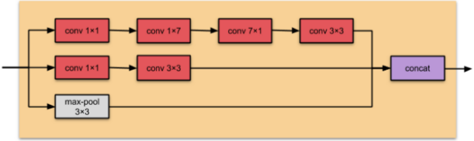
Inception-B

Block Inception B en keras



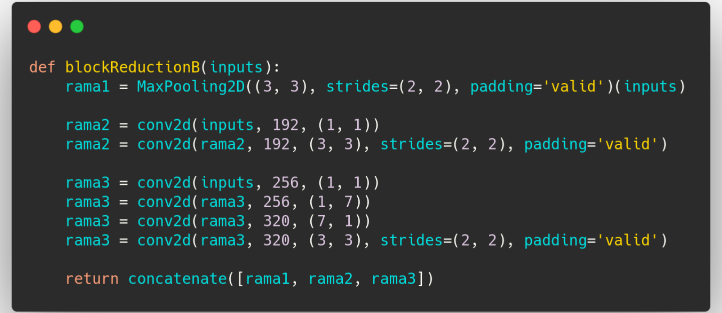
```
def blockInceptionB(inputs):
    rama1 = AveragePooling2D((3, 3), strides=(1, 1), padding='same')(inputs)
    rama1 = conv2d(rama1, 128, (1, 1))
    rama2 = conv2d(inputs, 384, (1, 1))
    rama3 = conv2d(inputs, 192, (1, 1))
    rama3 = conv2d(rama3, 224, (1, 7))
    rama3 = conv2d(rama3, 256, (7, 1))  # different from the paper
    rama4 = conv2d(inputs, 192, (1, 1))
    rama4 = conv2d(rama4, 192, (1, 7))
    rama4 = conv2d(rama4, 224, (7, 1))
    rama4 = conv2d(rama4, 224, (1, 7))
    rama4 = conv2d(rama4, 256, (7, 1))
    return concatenate([rama1, rama2, rama3, rama4])
```

Block Reduction B



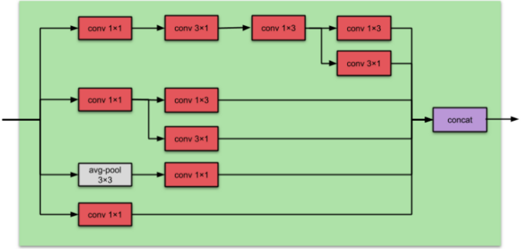
Reduction-B

Block Reduction B en keras



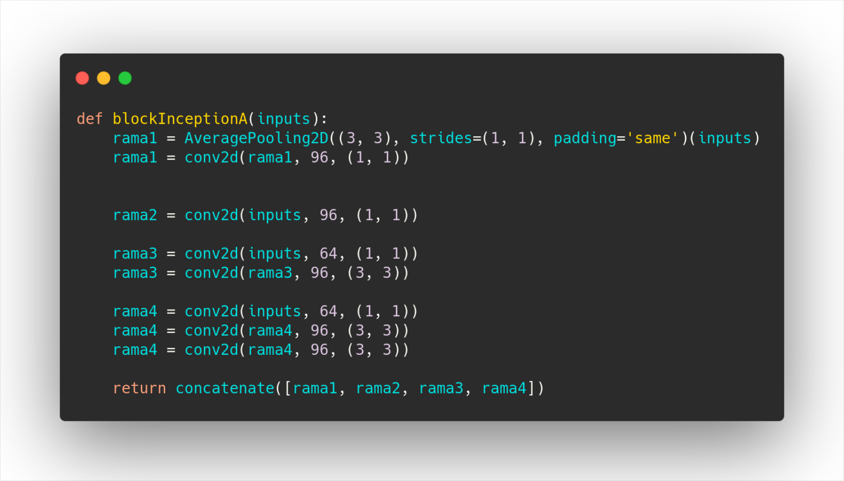
```
def blockReductionB(inputs):
    rama1 = MaxPooling2D((3, 3), strides=(2, 2), padding='valid')(inputs)

    rama2 = conv2d(inputs, 192, (1, 1))
    rama2 = conv2d(rama2, 192, (3, 3), strides=(2, 2), padding='valid')

    rama3 = conv2d(inputs, 256, (1, 1))
    rama3 = conv2d(rama3, 256, (1, 7))
    rama3 = conv2d(rama3, 320, (7, 1))
    rama3 = conv2d(rama3, 320, (3, 3), strides=(2, 2), padding='valid')

    return concatenate([rama1, rama2, rama3])
```

Block Inception C



Inception-C

Block Inception C en keras



```
def blockInceptionA(inputs):
    rama1 = AveragePooling2D((3, 3), strides=(1, 1), padding='same')(inputs)
    rama1 = conv2d(rama1, 96, (1, 1))


    rama2 = conv2d(inputs, 96, (1, 1))

    rama3 = conv2d(inputs, 64, (1, 1))
    rama3 = conv2d(rama3, 96, (3, 3))

    rama4 = conv2d(inputs, 64, (1, 1))
    rama4 = conv2d(rama4, 96, (3, 3))
    rama4 = conv2d(rama4, 96, (3, 3))

    return concatenate([rama1, rama2, rama3, rama4])
```

Construcción de la arquitectura

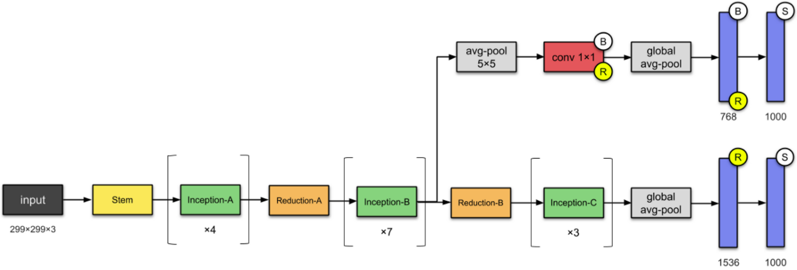
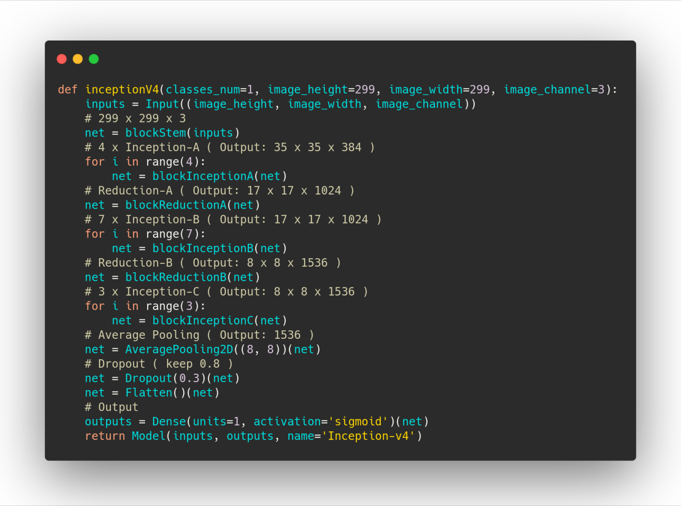


Figure: Modelo General

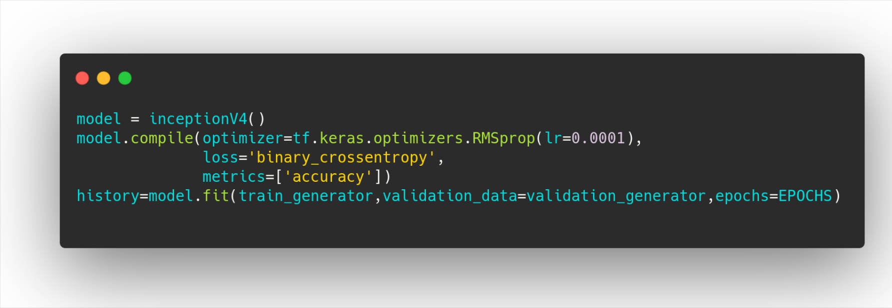
Construcción de la arquitectura en keras



```python
def inceptionV4(classes_num=1, image_height=299, image_width=299, image_channel=3):
    inputs = Input((image_height, image_width, image_channel))
    # 299 x 299 x 3
    net = blockStem(inputs)
    # 4 x Inception-A ( Output: 35 x 35 x 384 )
    for i in range(4):
        net = blockInceptionA(net)
    # Reduction-A ( Output: 17 x 17 x 1024 )
    net = blockReductionA(net)
    # 7 x Inception-B ( Output: 17 x 17 x 1024 )
    for i in range(7):
        net = blockInceptionB(net)
    # Reduction-B ( Output: 8 x 8 x 1536 )
    net = blockReductionB(net)
    # 3 x Inception-C ( Output: 8 x 8 x 1536 )
    for i in range(3):
        net = blockInceptionC(net)
    # Average Pooling ( Output: 1536 )
    net = AveragePooling2D((8, 8))(net)
    # Dropout ( keep 0.8 )
    net = Dropout(0.3)(net)
    net = Flatten()(net)
    # Output
    outputs = Dense(units=1, activation='sigmoid')(net)
    return Model(inputs, outputs, name='Inception-v4')
```

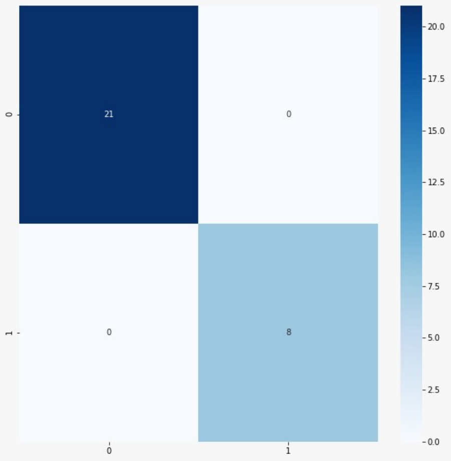
Figure: Inception v4

Compilación y entrenamiento

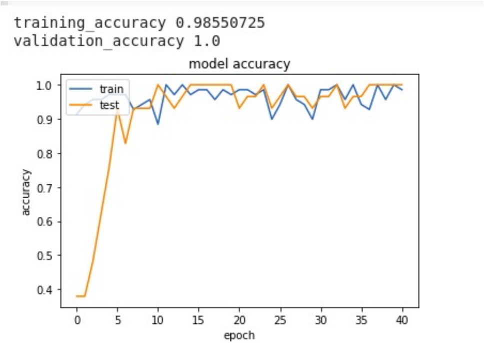


```
model = inceptionV4()
model.compile(optimizer=tf.keras.optimizers.RMSprop(lr=0.0001),
              loss='binary_crossentropy',
              metrics=['accuracy'])
history=model.fit(train_generator,validation_data=validation_generator,epochs=EPOCHS)
```

Resultados



Resultados



```
training_accuracy 0.98550725
validation_accuracy 1.0
```