



Tarea 1

Maestría en Inteligencia Artificial

MIA-203 Redes Neuronales y Aprendizaje Profundo

17/10/2024

Índice

1. Integrantes Grupo 3
2. Pregunta 1: MLP (Manual)
3. Pregunta 2: MLP (Microgradient y Pytorch)
4. Pregunta 3: Caso Lung cancer
 1. Entregables
 2. ResNet50
 3. Inceptionv1
 4. Inceptionv3
 5. DenseNet
 6. Comparación de resultados

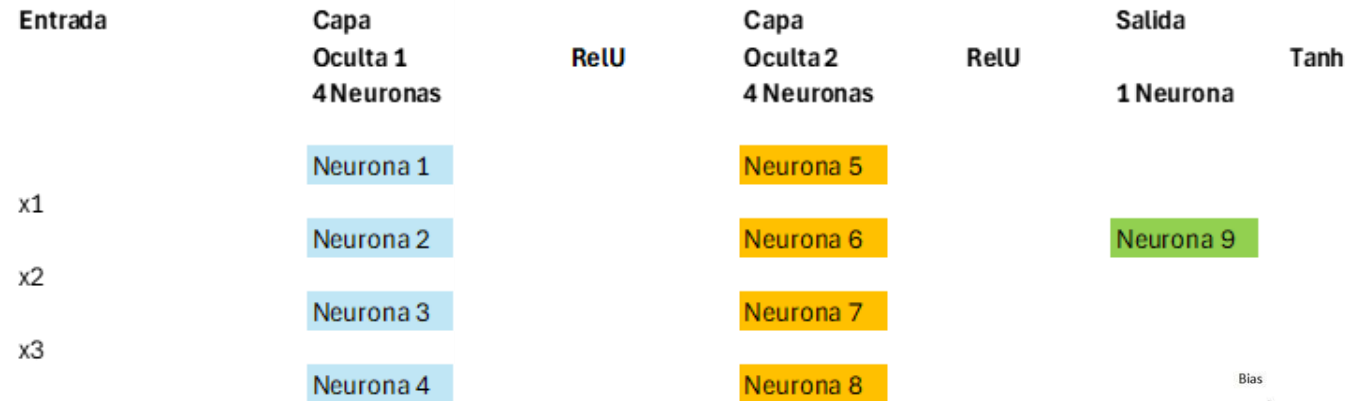


Integrantes grupo 3

1. Cieza Delgado, Hilber Alexander
2. Calderon Felix, Yan Franco
3. Hanco Mamani, William Milner
4. Parihuana Travesaño, Omar Eduardo
5. Talaverano Garcia, Julio Cesar



Pregunta 1: MLP (Manual) - Arquitectura



Entrada:

3 Neuronas que reciben los valores de entrada (en este caso, 3 características o valores).

Capa Oculta 1:

4 Neuronas.

Función de activación ReLU: Aplica la activación ReLU

Capa Oculta 2:

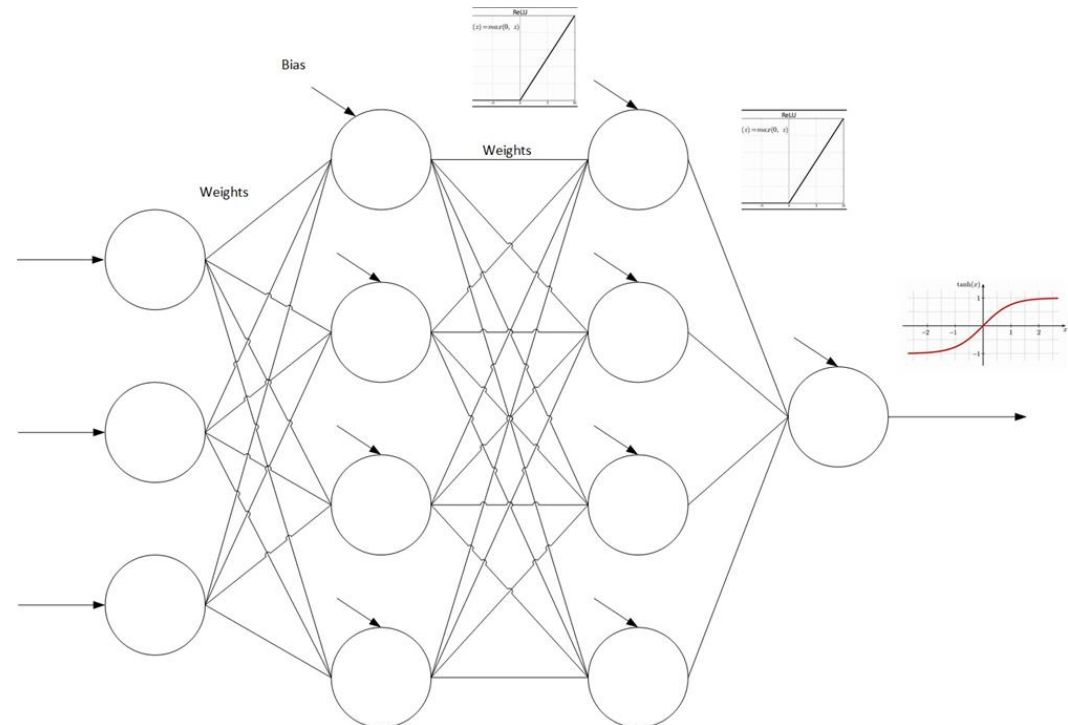
4 Neuronas.

Función de activación ReLU.

Capa de Salida:

1 Neurona

Función de activación Tangente Hiperbólica (Tanh): $(-1, 1)$



Pregunta 1: MLP (Manual) – Inicialización de pesos

Capa Oculta 1 (4 neuronas, 3 entradas)

Los pesos de la primera capa W1 deben moverse en el rango $(-0.577, 0.577)$

$$\text{Pesos } W1 = \begin{bmatrix} 0.1 & 0.5 & -0.2 \\ -0.3 & 0.4 & 0.1 \\ 0.2 & -0.1 & -0.5 \\ 0.05 & 0.3 & 0.2 \end{bmatrix}$$

$$\text{Sesgo } b1 = \begin{bmatrix} 0.05 \\ -0.07 \\ 0.02 \\ -0.1 \end{bmatrix}$$

Capa Oculta 2 (4 neuronas, 3 entradas)

Los pesos de la primera capa W2 deben moverse en el rango $(-0.5, 0.5)$

$$\text{Pesos } W2 = \begin{bmatrix} 0.1 & 0.4 & -0.1 & 0.2 \\ -0.2 & 0.3 & 0.2 & 0.4 \\ 0.3 & -0.1 & -0.4 & -0.1 \\ 0.45 & 0.2 & 0.35 & 0.3 \end{bmatrix}$$

$$\text{Sesgo } b2 = \begin{bmatrix} 0.05 \\ 0.1 \\ 0.3 \\ -0.1 \end{bmatrix}$$



Capa Salida (1 neuronas, 4 entradas)

Los pesos de la primera capa W1 deben moverse en el rango $(-0.577, 0.577)$

$$\text{Pesos } Wout = \begin{bmatrix} 0.5 & -0.4 & 0.4 & -0.2 \end{bmatrix}$$

$$\text{Sesgo } bout = 0.1$$

Pregunta 1: MLP (Manual) - forward

errori	=	y_i'	-	y_i		
--------	---	--------	---	-------	--	--

Entrada 1	error 1	=	0.2559	-	1	=	-0.7441
Entrada 2	error 2	=	0.0077	-	-1	=	1.0077
Entrada 3	error 3	=	0.2327	-	-1	=	1.2327
Entrada 4	error 4	=	0.0118	-	1	=	-0.9882

Final predictions (after tanh activation):

Prediction: 0.2560

Prediction: 0.0077

Prediction: 0.2327

Prediction: 0.0118



Pregunta 1: MLP (Manual)

Resumen de los Gradientes Finales: Primera Entrada

Gradiente W3

$$(\partial L / \partial W_{out}) = \begin{bmatrix} -0.438 \\ -0.211 \\ -0.436 \\ -0.983 \end{bmatrix}$$

Gradiente b3

$$(\partial L / \partial b_{out}) = -0.695$$

Gradiente W2

$$(\partial L / \partial W_2) = \begin{bmatrix} -0.452 & -0.111 & -0.088 & -0.205 \\ 0.544 & 0.134 & 0.106 & 0.247 \\ -0.363 & -0.090 & -0.071 & -0.165 \\ -0.299 & -0.074 & -0.058 & -0.136 \end{bmatrix}$$

Gradiente b2

$$(\partial L / \partial b_2) = \begin{bmatrix} -0.210 \\ 0.253 \\ -0.169 \\ -0.139 \end{bmatrix}$$

Gradiente W1

$$(\partial L / \partial W_1) = \begin{bmatrix} 1.675 & 2.345 & -0.335 \\ -0.035 & -0.049 & 0.007 \\ 0.188 & 0.263 & -0.038 \\ -0.250 & -0.350 & 0.050 \end{bmatrix}$$

Gradiente b1

$$(\partial L / \partial b_1) = \begin{bmatrix} 0.670 \\ -0.014 \\ 0.075 \\ -0.100 \end{bmatrix}$$



Pregunta 1: MLP (Manual)

Capa Salida:

$$Z_{out} = W_{out} * A_2 + b_{out}$$

$$Z_{out} = \begin{bmatrix} 0.5 & -0.4 & 0.4 & -0.2 \end{bmatrix} * \begin{bmatrix} 0.64 \\ 0.32 \\ 0.6 \\ 1.36 \end{bmatrix} + 0.1$$

$$Z_{out} = \begin{matrix} \text{Tanh} \\ 0.26 & 0.254 \end{matrix}$$

La activación final es:

$$y_1 = 0.254$$



Pregunta 2: MLP (Microgradient y Pytorch)

Revisar archivo: 2_Pregunta2_v2.ipynb



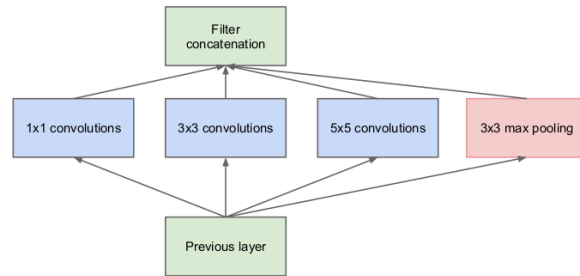
Caso: Lung cancer - Entregables

Modelo	Item	Nombre Archivo
Resnet50	Notebook	/3_lung-cancer_resnet50/Resnet50_whm_20241016.ipynb
Resnet50	Pesos	/3_lung-cancer_resnet50/model_resnet50_20241016.h5
Inceptionv1	Notebook	/3_lung-cancer_inceptionv1/Googlenet.ipynb
Inceptionv1	Pesos	/3_lung-cancer_inceptionv1/googlenet_model.pth
Inceptionv3	Notebook	/3_lung-cancer_inceptionv3/lung-cancer-transfer_learning-inceptionv3.ipynb
Inceptionv3	Pesos	/3_lung-cancer_inceptionv3/inception_v3_lung_cancer.pth
DenseNet121	Notebook	/3_lung-cancer_denseNet/lung-cancer-transfer_learning-denseNet.ipynb
DenseNet121	Pesos	/3_lung-cancer_denseNet/densenet_lung_cancer.pth

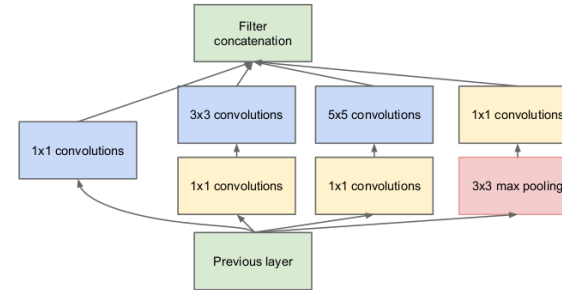
ResNet50 - Arquitectura

layer name	output size	18-layer	34-layer	50-layer	101-layer	152-layer
conv1	112×112	7×7, 64, stride 2				
conv2_x	56×56	3×3 max pool, stride 2				
		$\begin{bmatrix} 3 \times 3, 64 \\ 3 \times 3, 64 \end{bmatrix} \times 2$	$\begin{bmatrix} 3 \times 3, 64 \\ 3 \times 3, 64 \end{bmatrix} \times 3$	$\begin{bmatrix} 1 \times 1, 64 \\ 3 \times 3, 64 \\ 1 \times 1, 256 \end{bmatrix} \times 3$	$\begin{bmatrix} 1 \times 1, 64 \\ 3 \times 3, 64 \\ 1 \times 1, 256 \end{bmatrix} \times 3$	$\begin{bmatrix} 1 \times 1, 64 \\ 3 \times 3, 64 \\ 1 \times 1, 256 \end{bmatrix} \times 3$
conv3_x	28×28	$\begin{bmatrix} 3 \times 3, 128 \\ 3 \times 3, 128 \end{bmatrix} \times 2$	$\begin{bmatrix} 3 \times 3, 128 \\ 3 \times 3, 128 \end{bmatrix} \times 4$	$\begin{bmatrix} 1 \times 1, 128 \\ 3 \times 3, 128 \\ 1 \times 1, 512 \end{bmatrix} \times 4$	$\begin{bmatrix} 1 \times 1, 128 \\ 3 \times 3, 128 \\ 1 \times 1, 512 \end{bmatrix} \times 4$	$\begin{bmatrix} 1 \times 1, 128 \\ 3 \times 3, 128 \\ 1 \times 1, 512 \end{bmatrix} \times 8$
conv4_x	14×14	$\begin{bmatrix} 3 \times 3, 256 \\ 3 \times 3, 256 \end{bmatrix} \times 2$	$\begin{bmatrix} 3 \times 3, 256 \\ 3 \times 3, 256 \end{bmatrix} \times 6$	$\begin{bmatrix} 1 \times 1, 256 \\ 3 \times 3, 256 \\ 1 \times 1, 1024 \end{bmatrix} \times 6$	$\begin{bmatrix} 1 \times 1, 256 \\ 3 \times 3, 256 \\ 1 \times 1, 1024 \end{bmatrix} \times 23$	$\begin{bmatrix} 1 \times 1, 256 \\ 3 \times 3, 256 \\ 1 \times 1, 1024 \end{bmatrix} \times 36$
conv5_x	7×7	$\begin{bmatrix} 3 \times 3, 512 \\ 3 \times 3, 512 \end{bmatrix} \times 2$	$\begin{bmatrix} 3 \times 3, 512 \\ 3 \times 3, 512 \end{bmatrix} \times 3$	$\begin{bmatrix} 1 \times 1, 512 \\ 3 \times 3, 512 \\ 1 \times 1, 2048 \end{bmatrix} \times 3$	$\begin{bmatrix} 1 \times 1, 512 \\ 3 \times 3, 512 \\ 1 \times 1, 2048 \end{bmatrix} \times 3$	$\begin{bmatrix} 1 \times 1, 512 \\ 3 \times 3, 512 \\ 1 \times 1, 2048 \end{bmatrix} \times 3$
	1×1	average pool, 1000-d fc, softmax				
FLOPs		1.8×10^9	3.6×10^9	3.8×10^9	7.6×10^9	11.3×10^9

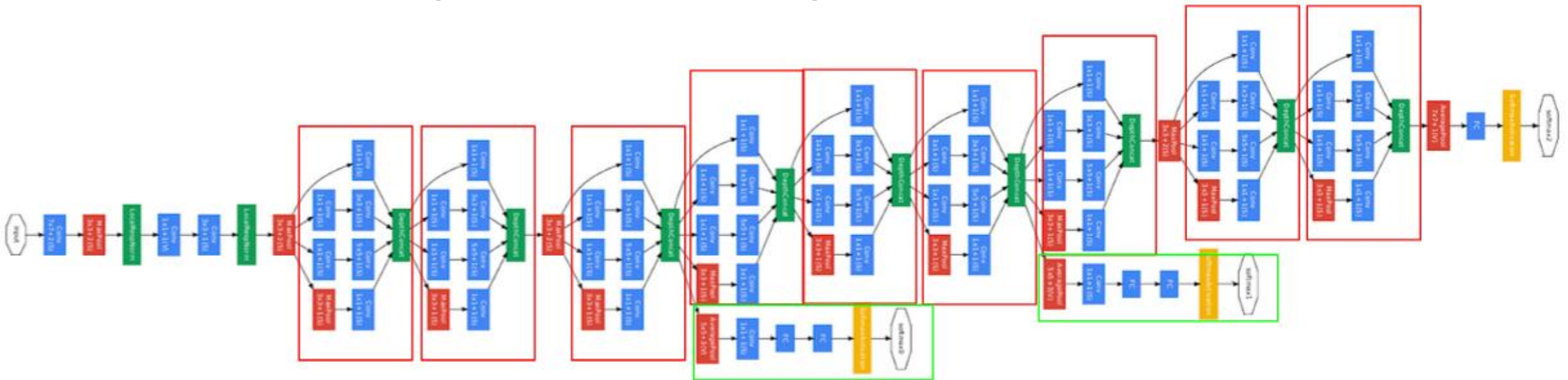
Inceptionv1 - Arquitectura



(a) Inception module, naïve version



(b) Inception module with dimension reductions



Inceptionv3 - Arquitectura

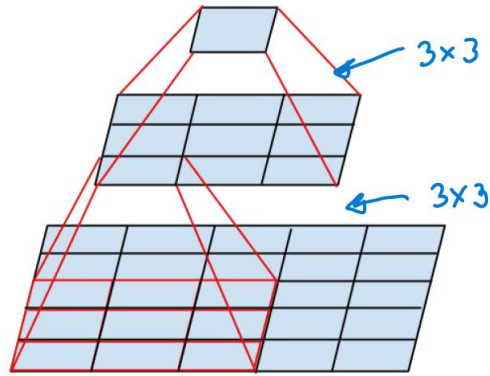


Figure 1. Mini-network replacing the 5×5 convolutions.

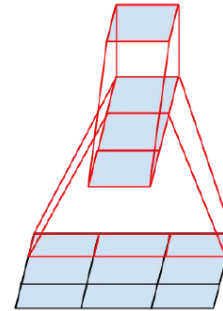


Figure 3. Mini-network replacing the 3×3 convolutions. The lower layer of this network consists of a 3×1 convolution with 3 output units.

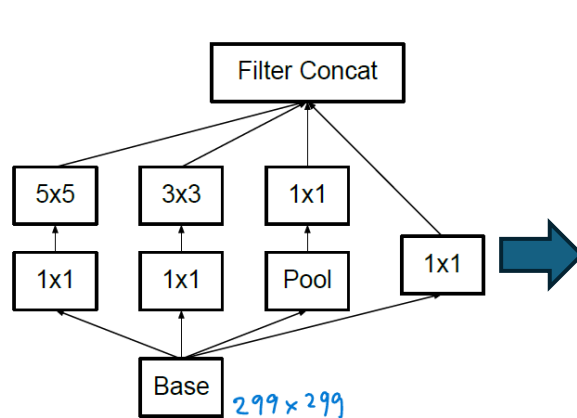


Figure 4. Original Inception module as described in [20].

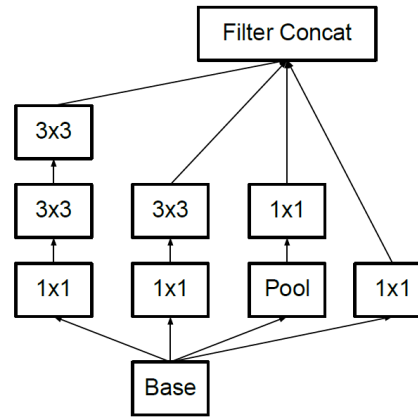


Figure 5. Inception modules where each 5×5 convolution is replaced by two 3×3 convolution, as suggested by principle [3] of Section 2.

type	patch size/stride or remarks	input size
conv	$3 \times 3 / 2$	$299 \times 299 \times 3$ ← Img
conv	$3 \times 3 / 1$	$149 \times 149 \times 32$
conv padded	$3 \times 3 / 1$	$147 \times 147 \times 32$
pool	$3 \times 3 / 2$	$147 \times 147 \times 64$
conv	$3 \times 3 / 1$	$73 \times 73 \times 64$
conv	$3 \times 3 / 2$	$71 \times 71 \times 80$
conv	$3 \times 3 / 1$	$35 \times 35 \times 192$
$3 \times$ Inception	As in figure 5	$35 \times 35 \times 288$
$5 \times$ Inception	As in figure 6	$17 \times 17 \times 768$
$2 \times$ Inception	As in figure 7	$8 \times 8 \times 1280$
pool	8×8	$8 \times 8 \times 2048$
linear	logits	$1 \times 1 \times 2048$
softmax	classifier	$1 \times 1 \times 1000$

Inceptionv3 - Arquitectura

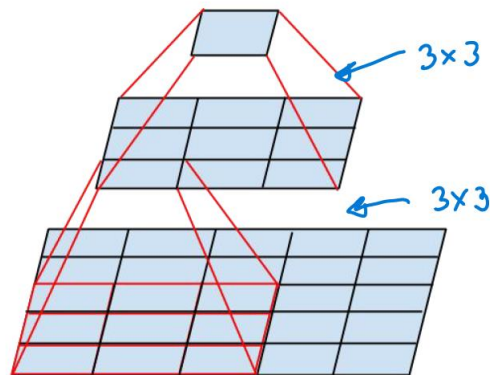


Figure 1. Mini-network replacing the 5×5 convolutions.

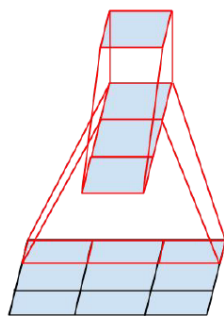


Figure 3. Mini-network replacing the 3×3 convolutions. The lower layer of this network consists of a 3×1 convolution with 3 output units.

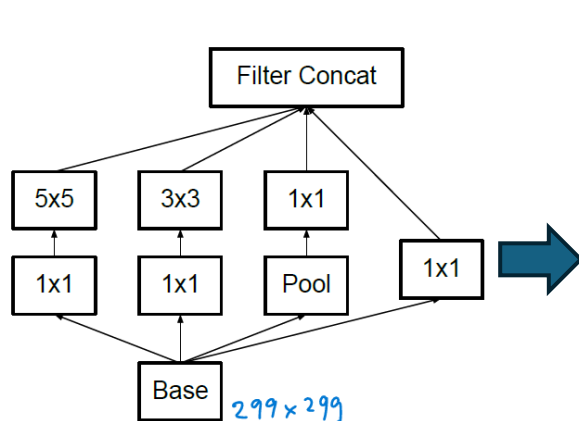


Figure 4. Original Inception module as described in [20].

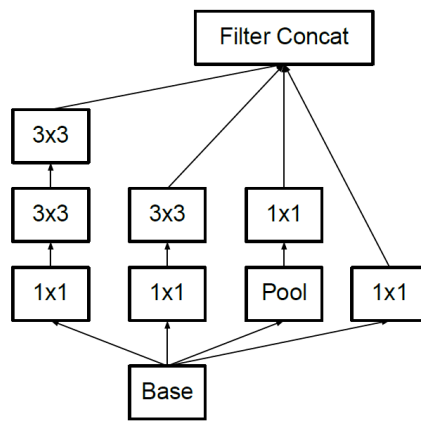
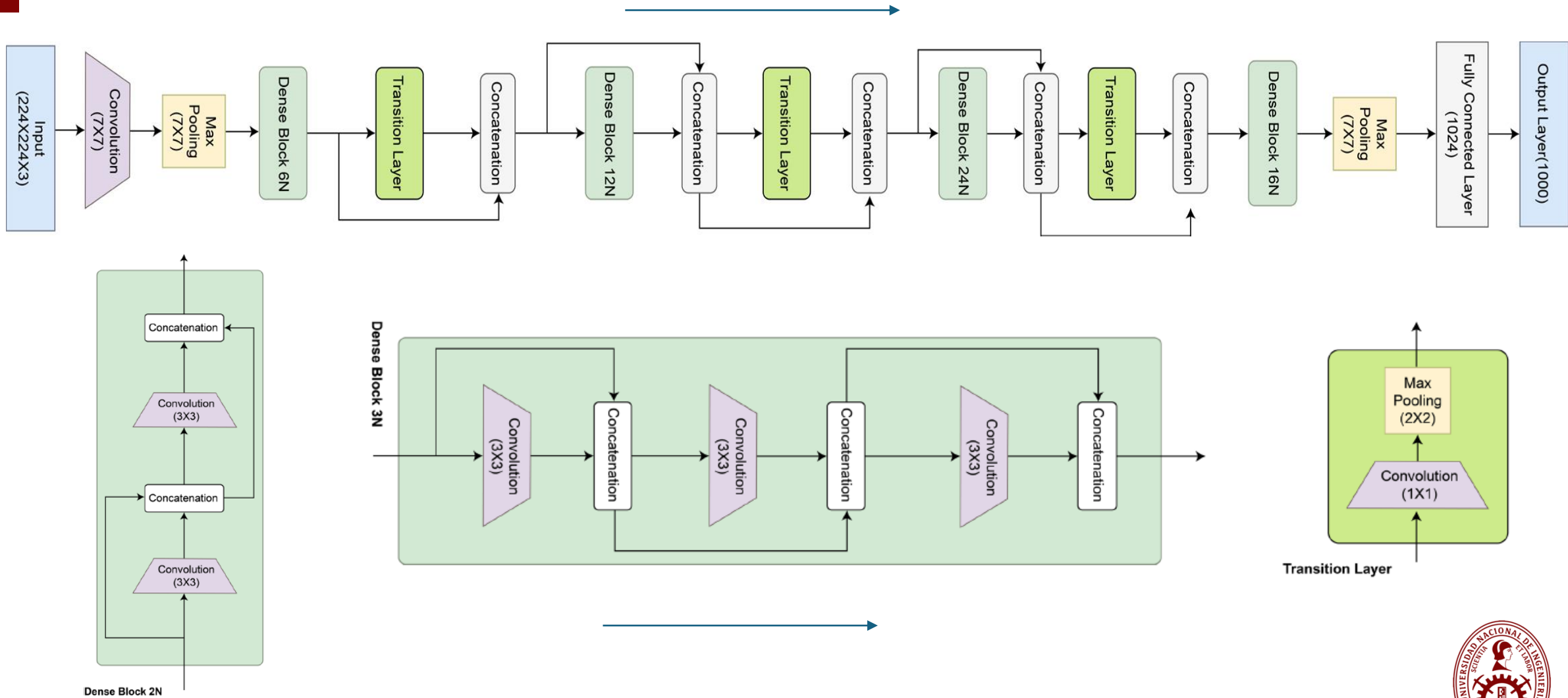


Figure 5. Inception modules where each 5×5 convolution is replaced by two 3×3 convolution, as suggested by principle 3 of Section 2.

type	patch size/stride or remarks	input size
conv	$3 \times 3 / 2$	$299 \times 299 \times 3$
conv	$3 \times 3 / 1$	$149 \times 149 \times 32$
conv padded	$3 \times 3 / 1$	$147 \times 147 \times 32$
pool	$3 \times 3 / 2$	$147 \times 147 \times 64$
conv	$3 \times 3 / 1$	$73 \times 73 \times 64$
conv	$3 \times 3 / 2$	$71 \times 71 \times 80$
conv	$3 \times 3 / 1$	$35 \times 35 \times 192$
$3 \times$ Inception	As in figure 5	$35 \times 35 \times 288$
$5 \times$ Inception	As in figure 6	$17 \times 17 \times 768$
$2 \times$ Inception	As in figure 7	$8 \times 8 \times 1280$
pool	8×8	$8 \times 8 \times 2048$
linear	logits	$1 \times 1 \times 2048$
softmax	classifier	$1 \times 1 \times 1000$

← Img

DenseNet - Arquitectura



Comparativa de Modelos CNN - Lung Cancer

	ResNet50	Inception V1	Inception V3	DenseNet121
Total Parámetros	23,593,859	6,616,840	25,118,411	7,978,856
Capas (Aprox)	50	22	48	121
Parámetros entrenables	6,147	6,616,840	6,147	1,025,000
Épocas	100	10	100	100
Accuracy	97.73%	98.01%	96.67%	96.74%
Batch_size	64	32	64	32
Metodo	Transfer Learning		Transfer Learning	Transfer Learning
Librería	TensorFlow	Pytorch	Pytorch	Pytorch

