



# Classez des images à l'aide d'algorithmes de Deep Learning

Openclassrooms – IML P6 – Justine JARLETON



# Sommaire



MISSION



ANALYSE



MODÈLE  
PERSONNEL



TRANSFER  
LEARNING



CONCLUSION



# La mission



?







# Analyse & preprocessing

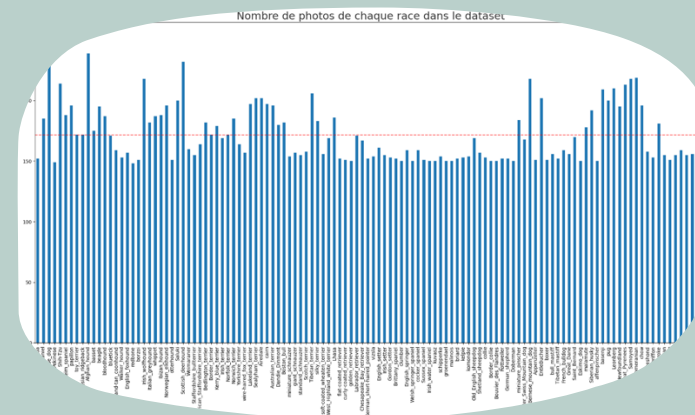


# Le dataset

**120**  
races

**150 à  
250**  
photos par  
race

**20 580**  
images



# (Pré)Traitement des images

Réduction du  
bruit

Recalibrage des  
histogrammes

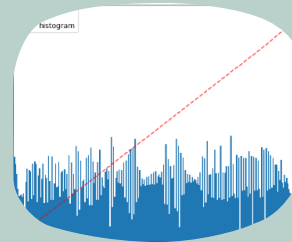
Application de  
filtres

Augmentation  
des données

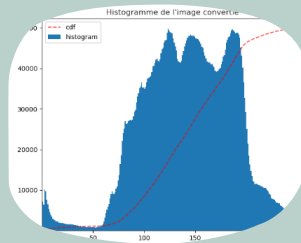
Réduction de la  
dimensionnalité



# (pré)Traitement des images



357\*500



Egalisation



299\*299

Redimensionnement



# Préparation (commune)



## CHOIX DE 5 RACES



*Bichon maltais*



*Deerhound*



*Bouledogue français*

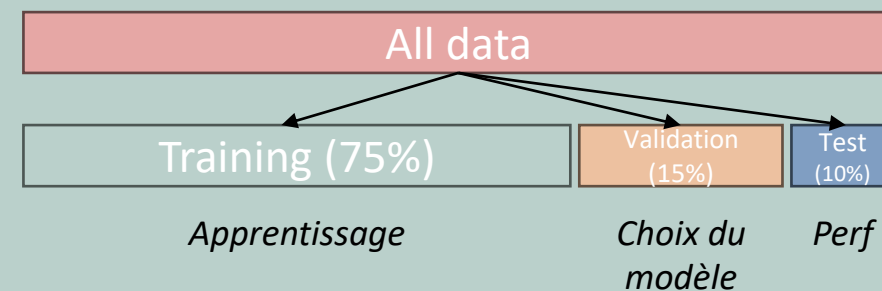


*Lévrier Afghan*



*Loulou de Poméranie*

## PARTITIONNEMENT







# Métriques

- Accuracy ( $(TP+TN) / (tot)$ )
- Precision ( $TP/(TP+FP)$ )
- Recall ( $TP/(TP+FN)$ )
- F1-Score

$$F1-Score = 2 \times \frac{Precision \times Recall}{Precision + Recall}$$

		True Class	
		Positive	Negative
Predicted Class	Positive	TP	FP
	Negative	FN	TN



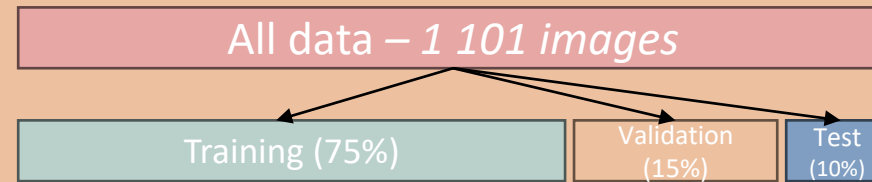
# Modèle personnel

("from scratch")



# Préparation

- Partition



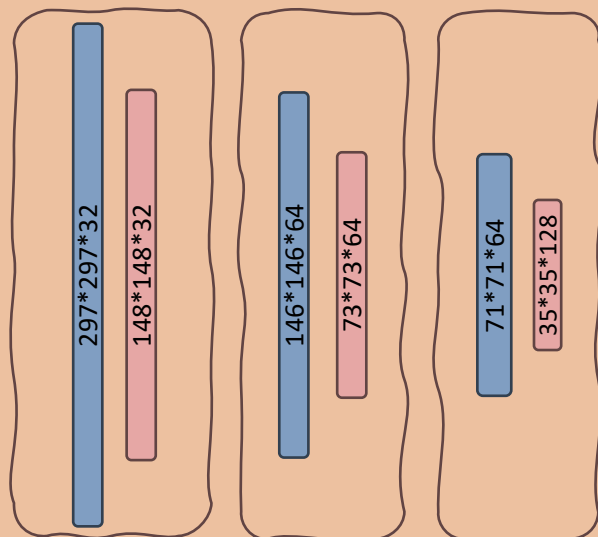
- Data augmentation

- Rotation : 0 à 40°
- Décalage horizontal : 0 à 20%,
- Décalage vertical : 0 à 20%,
- Cisaillement : 0 à 20%,
- Zoom = 0 à 20%,
- Retournement horizontal : True





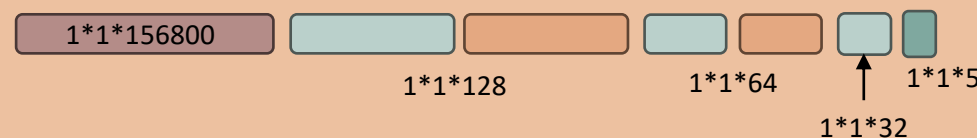
# Construction du modèle



1<sup>ère</sup> couche Conv :  
 - 32 filtres (taille 3x3)  
 - activation Relu  
 - MaxPooling pour réduction de dimension

3<sup>ème</sup> couche Conv :  
 - 128 filtres (taille 3x3)  
 - activation Relu  
 - MaxPooling

2<sup>ème</sup> couche Conv :  
 - 64 filtres (taille 3x3)  
 - activation Relu  
 - MaxPooling



Model: "sequential"

Layer (type)	Output Shape	Param #
conv2d (Conv2D)	(None, 297, 297, 32)	896
max_pooling2d (MaxPooling2D)	(None, 148, 148, 32)	0
conv2d_1 (Conv2D)	(None, 146, 146, 64)	18,496
max_pooling2d_1 (MaxPooling2D)	(None, 73, 73, 64)	0
conv2d_2 (Conv2D)	(None, 71, 71, 128)	73,856
max_pooling2d_2 (MaxPooling2D)	(None, 35, 35, 128)	0
flatten (Flatten)	(None, 156800)	0
dense (Dense)	(None, 128)	20,070,528
dropout (Dropout)	(None, 128)	0
dense_1 (Dense)	(None, 64)	8,256
dropout_1 (Dropout)	(None, 64)	0
dense_2 (Dense)	(None, 32)	2,080
dense_3 (Dense)	(None, 5)	165

Total params: 20,174,277 (76.96 MB)  
 Trainable params: 20,174,277 (76.96 MB)  
 Non-trainable params: 0 (0.00 B)

Conv + Relu

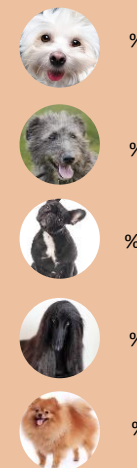
Max pooling

Flatten

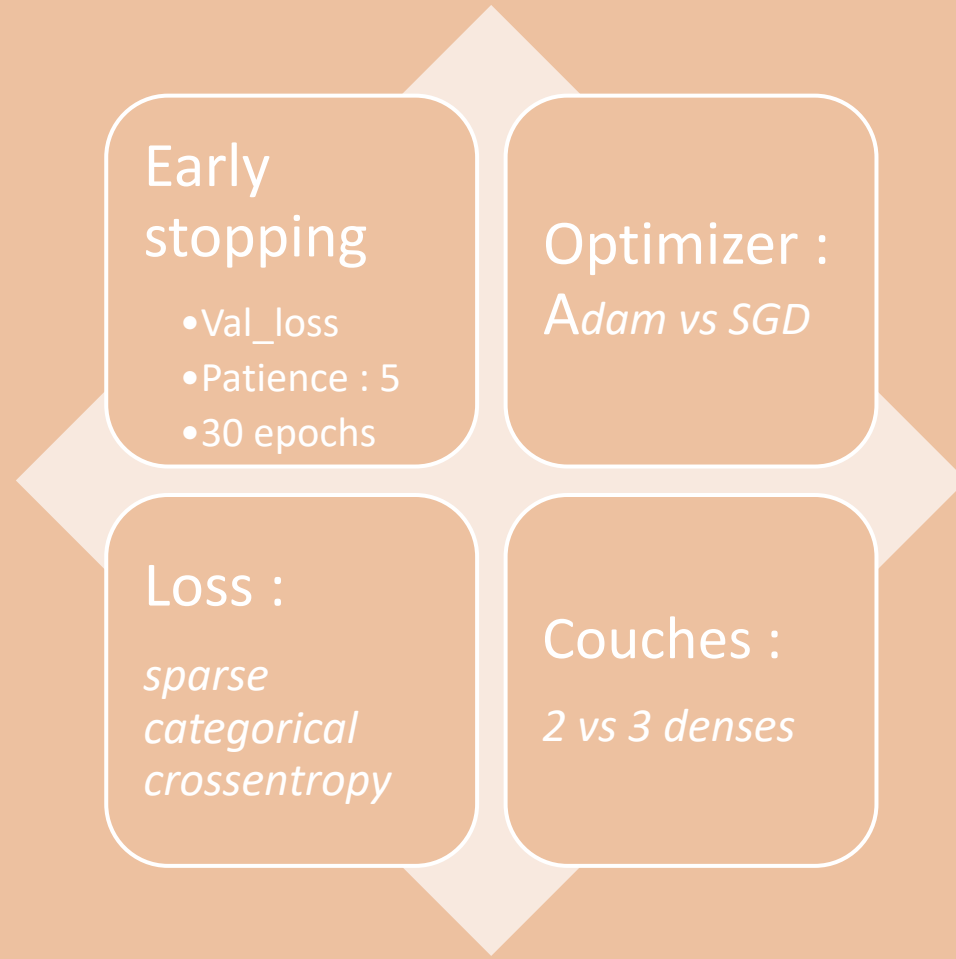
Dense + ReLu

Dense + Softmax

Dropout (0.5)

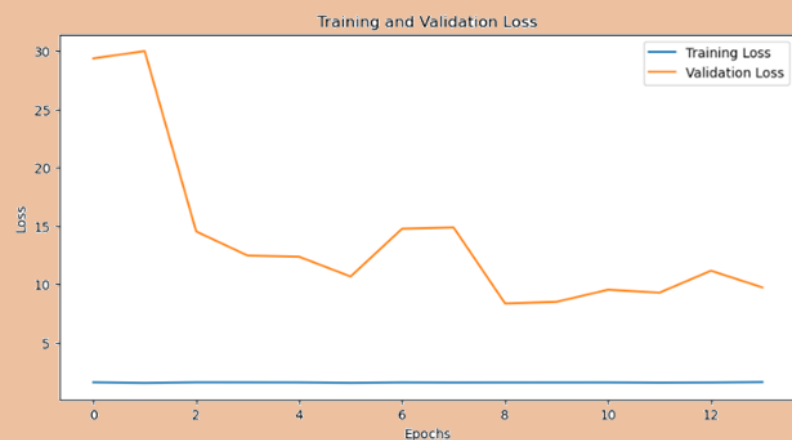
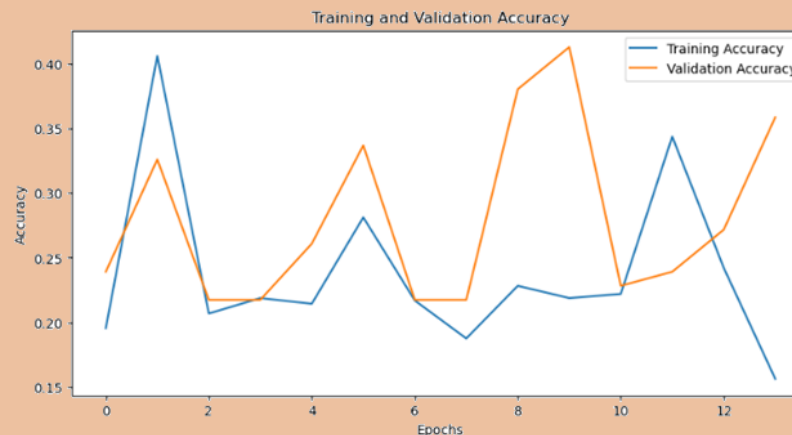
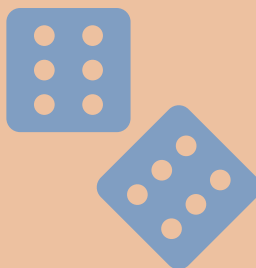


# Fine tuning



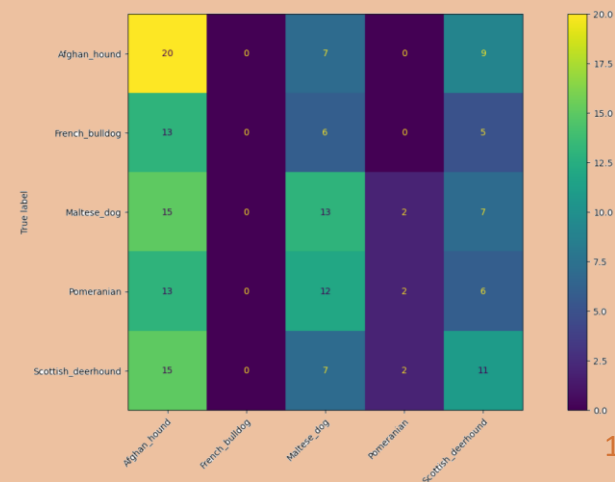
# Résultats

? %



Metrics			Parameters			
Duration	accuracy	loss	Nb denses	Nom test	epochs	optimizer
8.9s	0.460606068...	39.56311798...	2 denses	scratch - 75/15/10	10	adam
10.5s	0.369696974...	58.46077346...	2 denses	scratch - 75/15/10	10	adam
6.7s	0.351515144...	12.80403614...	3 denses	scratch - 75/15/10	10	SGD
10.4s	0.303030312...	69.62768554...	2 denses	scratch - 75/15/10	30	adam
9.3s	0.248484849...	68.31581878...	2 denses	scratch - 75/15/10	10	adam
5.9s	0.236363634...	9.006441116...	3 denses	scratch - 75/15/10	30	SGD

mlflow









# Transfer learning



# Modèles disponibles

- Librairie Keras



Model	Size (MB)	Top-1 Accuracy	Top-5 Accuracy	Parameters	Depth	Time (ms) per inference step (CPU)	Time (ms) per inference step (GPU)
Xception	88	79.0%	94.5%	22.9M	81	109.4	8.1
VGG16	528	71.3%	90.1%	138.4M	16	69.5	4.2
VGG19	549	71.3%	90.0%	143.7M	19	84.8	4.4
ResNet50	98	74.9%	92.1%	25.6M	107	58.2	4.6

- Base d'entraînement : ImageNet (disponible pour la recherche et l'utilisation non commerciale)





# VGG16



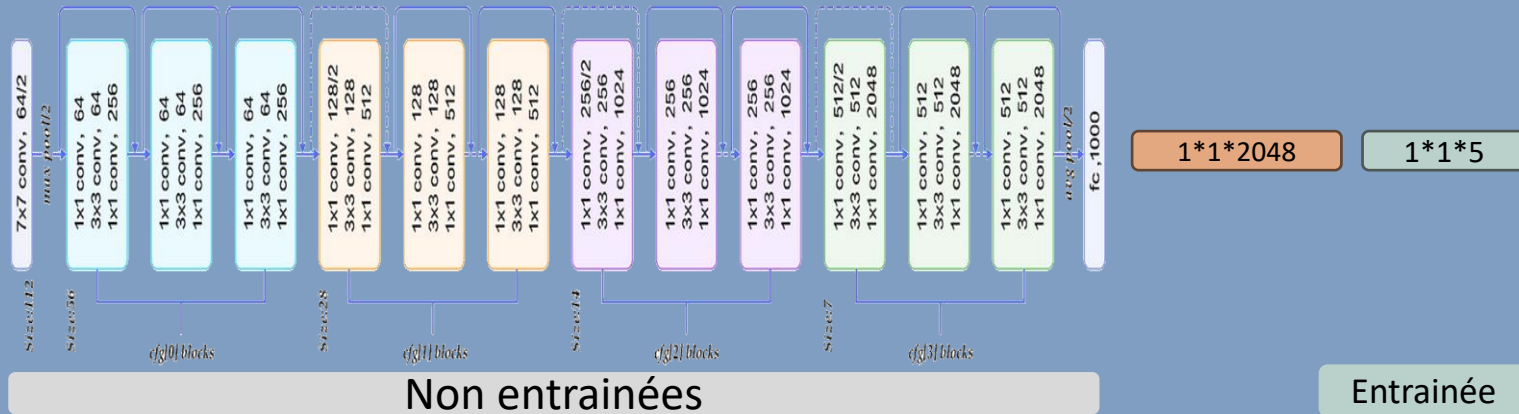
- Format 224 x 224
- Early stopping
- Optimizer : Adam / SGD

flatten (Flatten)	(None, 25088)	0
dense (Dense)	(None, 5)	125,445

Total params: 14,840,133 (56.61 MB)  
 Trainable params: 125,445 (490.02 KB)  
 Non-trainable params: 14,714,688 (56.13 MB)



# Resnet50



- Format 224 x 224
- Early stopping
- Optimizer : Adam / SGD

Total params: 23,597,957 (90.02 MB)  
 Trainable params: 10,245 (40.02 KB)  
 Non-trainable params: 23,587,712 (89.98 MB)

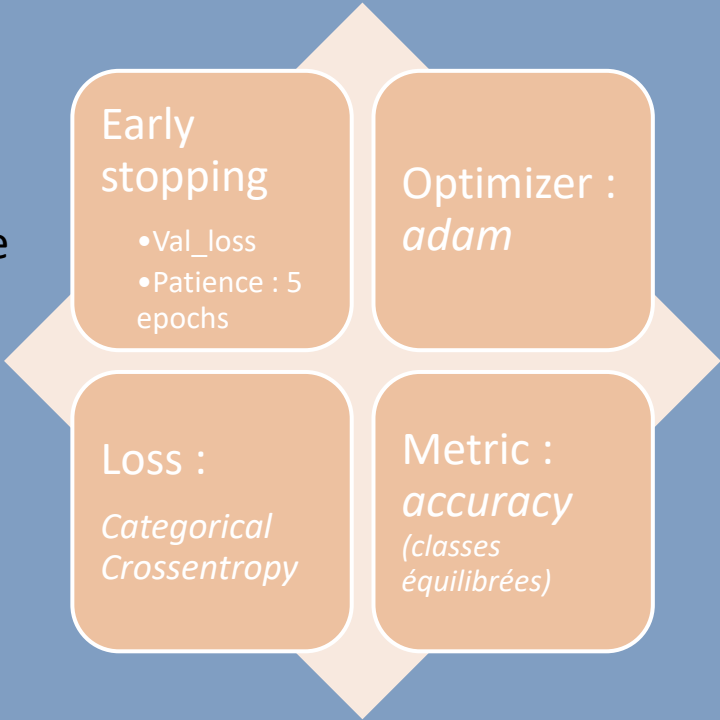


# Fine tuning

○ L'ajout de couches denses n'améliore pas le modèle

- **Resnet :**
  - Plus rapide
  - Meilleurs accuracy et loss

98%



Run Name	Created	Duration	Metrics		Parameters	
			accuracy ↕	loss	Nom test	optimizer
blushing-skink-912	4 minutes ago	25.0s	0.981981992...	0.115026935...	Resnet Pooling + dense + split(75/15/10)	adam
bittersweet-auk-417	3 days ago	28.7s	0.981981992...	0.106914453...	Resnet Pooling + dense	adam
brawny-sow-718	3 days ago	25.3s	0.963963985...	0.126442149...	Resnet Pooling + dense	adam
masked-trout-631	3 days ago	22.4s	0.963963985...	0.085881754...	Resnet Pooling + dense + dense	adam
melodic-cod-904	3 days ago	41.6s	0.954954981...	2.824830770...	VGG16 Flatten + dense + dense	adam
peaceful-bass-195	3 days ago	26.6s	0.945945918...	0.165282666...	Resnet Pooling + dense	Stochastic G...
tasteful-zebra-907	3 days ago	24.9s	0.936936914...	0.253465980...	Resnet Pooling + dense	Stochastic G...
bustling-sponge-560	3 days ago	46.3s	0.936936914...	3.492623567...	VGG16 Flatten + dense	adam
stylish-fawn-253	3 days ago	44.9s	0.936936914...	4.387056827...	VGG16 Flatten + dense + dense	adam
sedate-grouse-215	1 hour ago	25.8s	0.932330846...	0.192885816...	Resnet Pooling + dense + split	adam
legendary-auk-363	3 days ago	49.3s	0.927927911...	385.9506225...	VGG16 Flatten + dense	Stochastic G...
abundant-turtle-254	3 days ago	43.8s	0.927927911...	504.5333557...	VGG16 Flatten + dense	Stochastic G...







# Prédiction







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# Conclusion

- Très belle performance avec ResNet
- Importance de la base de données d'entraînement
- /!\ la performance devrait diminuer avec l'ajout de races (classes) – à étudier



# Merci!



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