

Redes Neurais Artificiais

Teoria e Prática

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Doutor em Robótica e *Machine Learning* pelo ICMC-USP



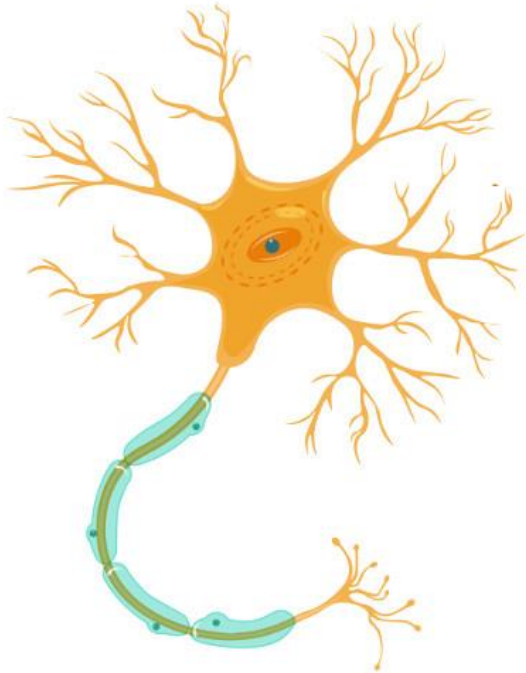
Redes Neurais

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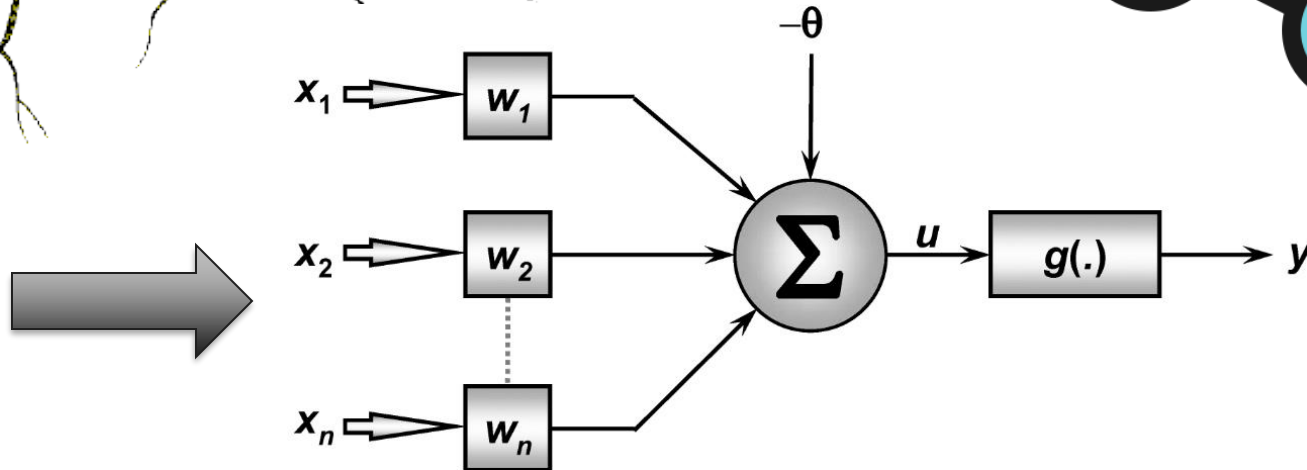
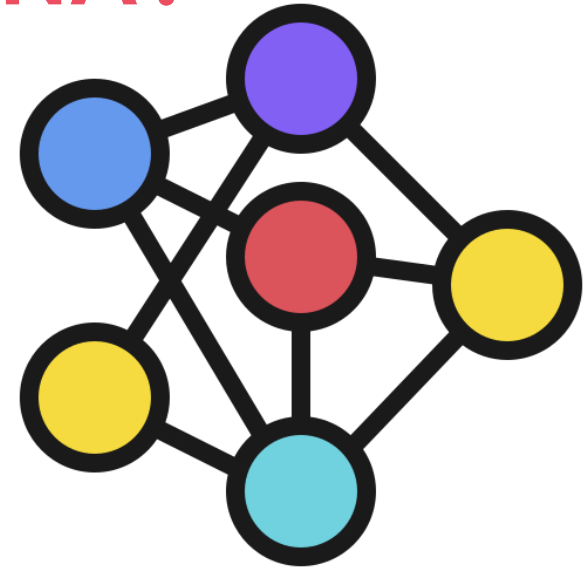
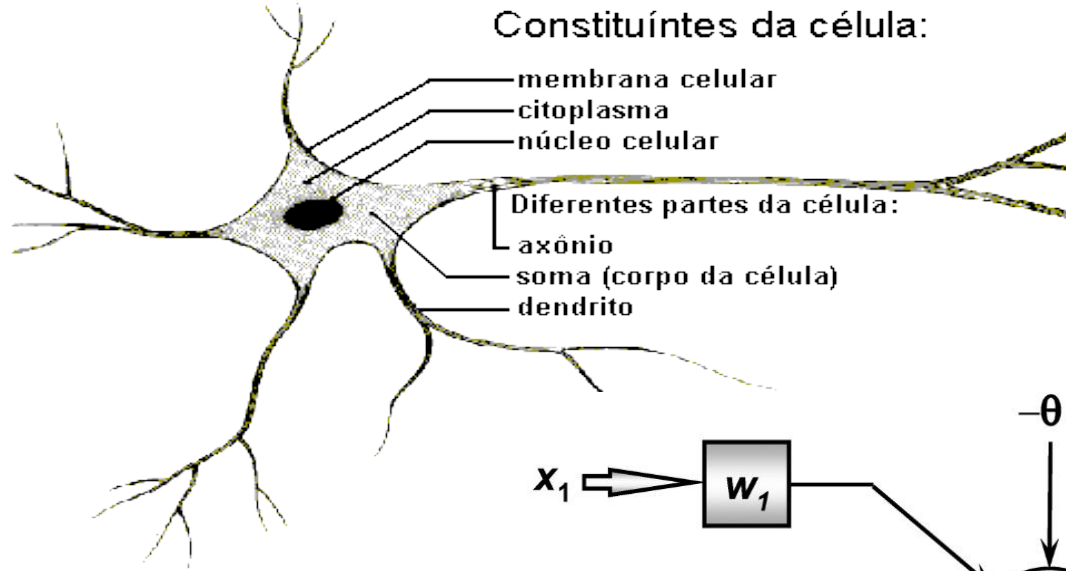


O que são Redes Neurais?

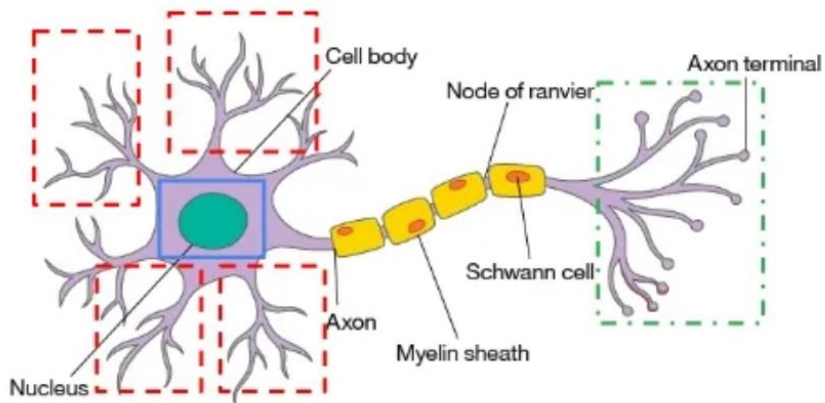
Redes Neurais



Qual a estrutura de uma RNA?



Redes Biológicas x Artificiais



neurônio



dendritos / pesos



núcleo / unidade



axônio+sinapse / saída

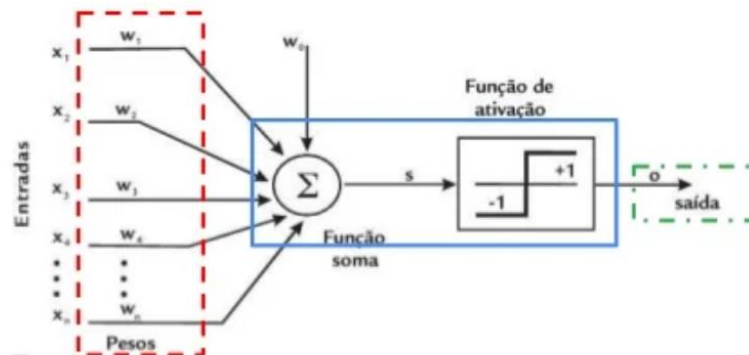
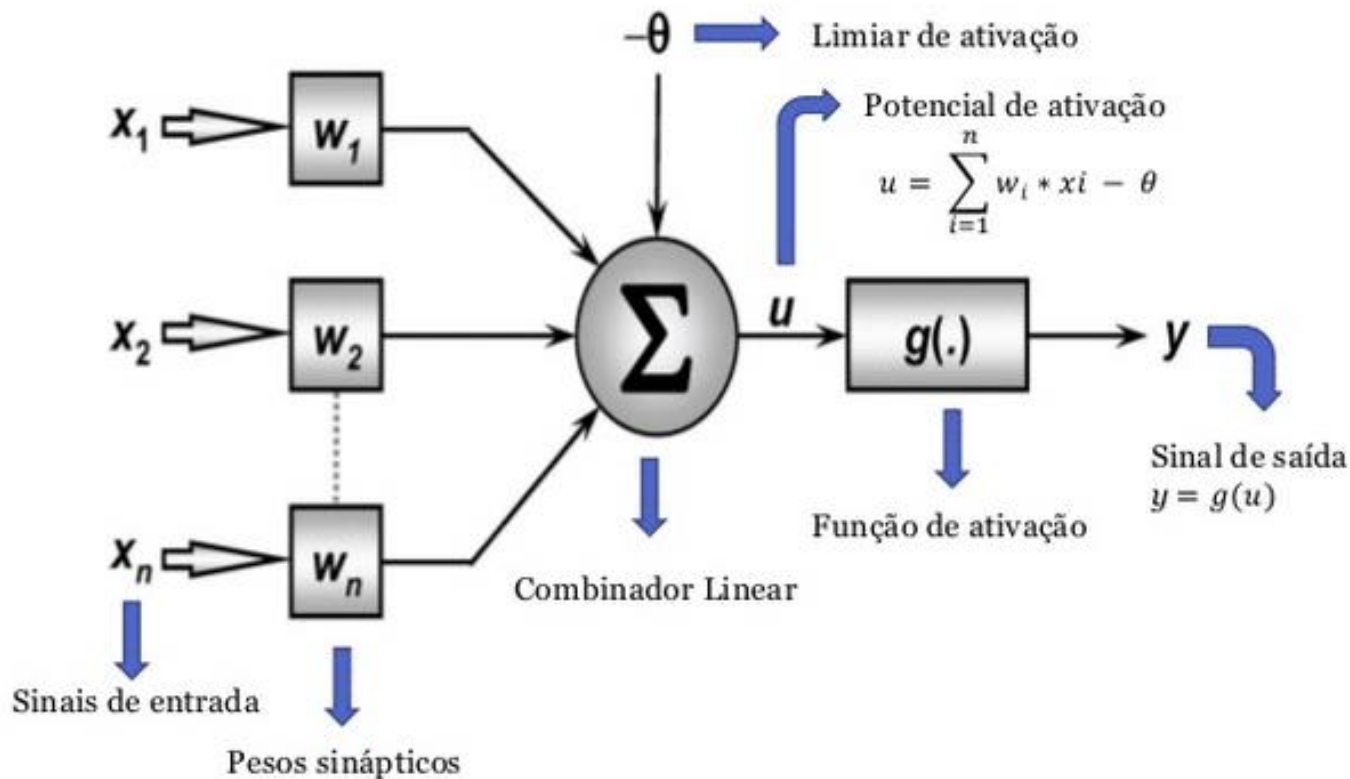


Figura 1

Modelo de um neurônio perceptron de Rosenblatt. Fonte: Adaptado de Medeiros (2006, p. 3).

neurônio artificial

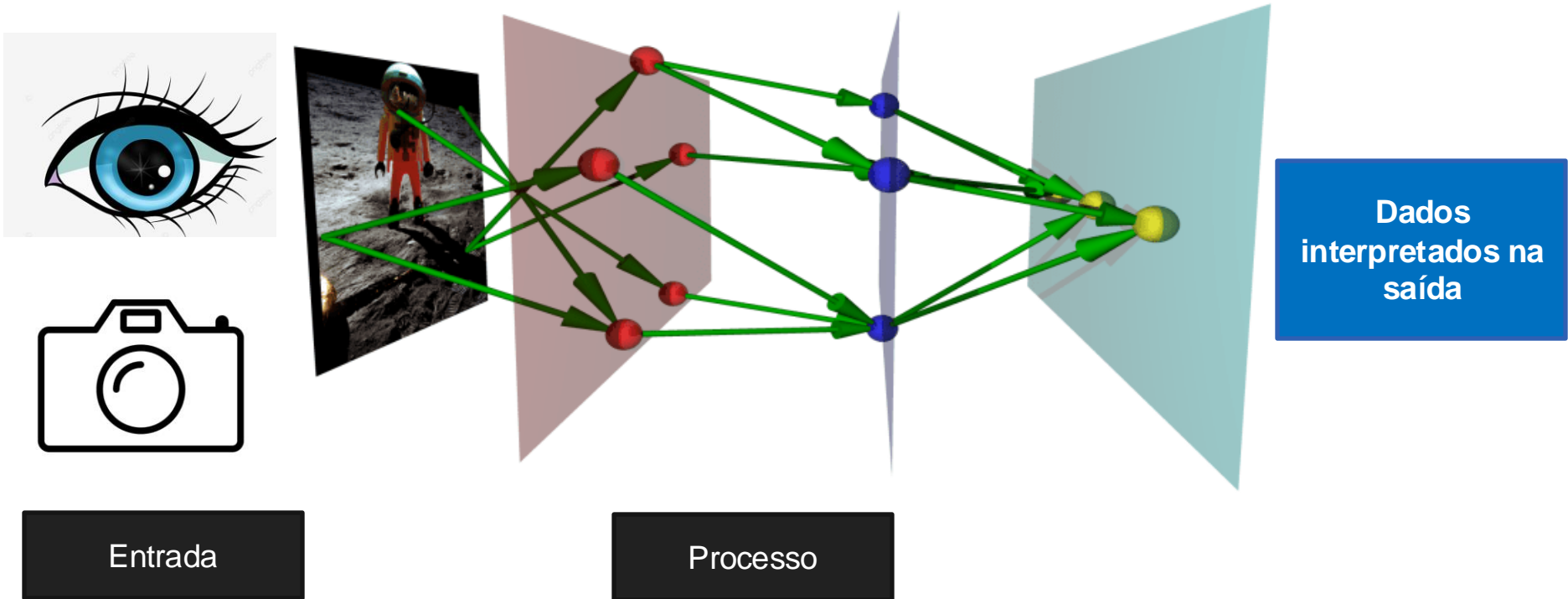
Neurônio Artificial



Dados de entrada e saída



Redes Neurais Biológicas x Artificiais



Relação de entrada e saída



Imagem de Entrada

08	02	22	97	38	15	00	40	00	75	04	05	07	78	52	12	50	77	01	28
49	49	99	40	17	81	18	57	60	87	17	40	98	43	69	45	56	62	00	
81	49	31	73	55	79	14	29	93	71	40	67	58	38	30	03	49	13	36	65
32	70	95	23	04	60	11	42	69	24	68	56	01	32	56	71	37	02	36	91
22	31	16	71	51	67	85	89	41	92	36	54	22	40	40	28	66	33	13	80
24	47	73	80	99	03	45	02	44	75	33	53	78	36	84	20	35	17	12	50
32	95	81	28	64	23	67	10	26	38	40	67	59	54	70	66	18	38	64	70
67	26	20	68	02	62	12	20	95	63	94	39	63	08	40	91	66	49	94	21
24	35	58	05	66	73	99	26	97	17	78	78	96	83	14	88	34	89	63	72
21	36	23	09	75	00	76	44	20	45	35	14	00	61	33	97	34	31	33	95
78	17	53	28	22	75	31	67	15	94	03	80	04	62	16	14	09	53	56	92
16	39	05	42	96	35	31	47	55	58	88	24	00	17	54	24	36	29	85	57
86	56	00	48	35	71	89	07	05	44	44	37	44	60	21	58	51	54	17	58
19	80	81	68	05	94	47	69	28	73	92	13	86	52	17	77	04	89	55	40
04	52	08	83	97	35	99	16	07	97	57	32	16	26	26	79	33	27	98	66
66	56	68	87	57	62	20	72	03	46	33	67	46	55	12	32	63	93	53	69
04	42	16	73	58	35	39	11	24	94	72	18	08	46	29	32	40	62	76	36
20	69	36	41	72	30	23	88	34	68	59	69	82	67	59	85	74	04	36	16
20	73	35	29	78	31	90	01	74	31	49	71	48	56	81	16	23	57	05	54
01	70	54	71	83	51	54	69	16	92	33	48	61	43	52	01	89	27	67	48

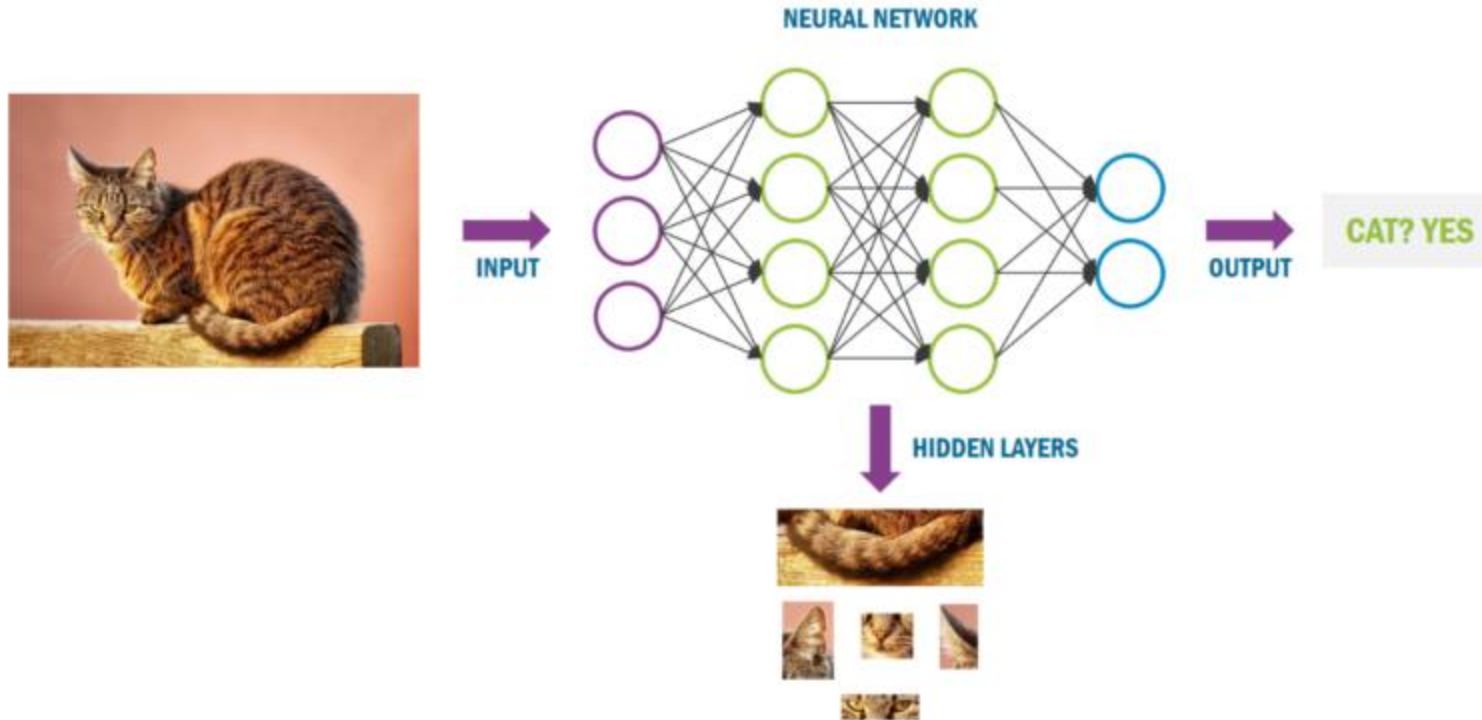
Dados gerados



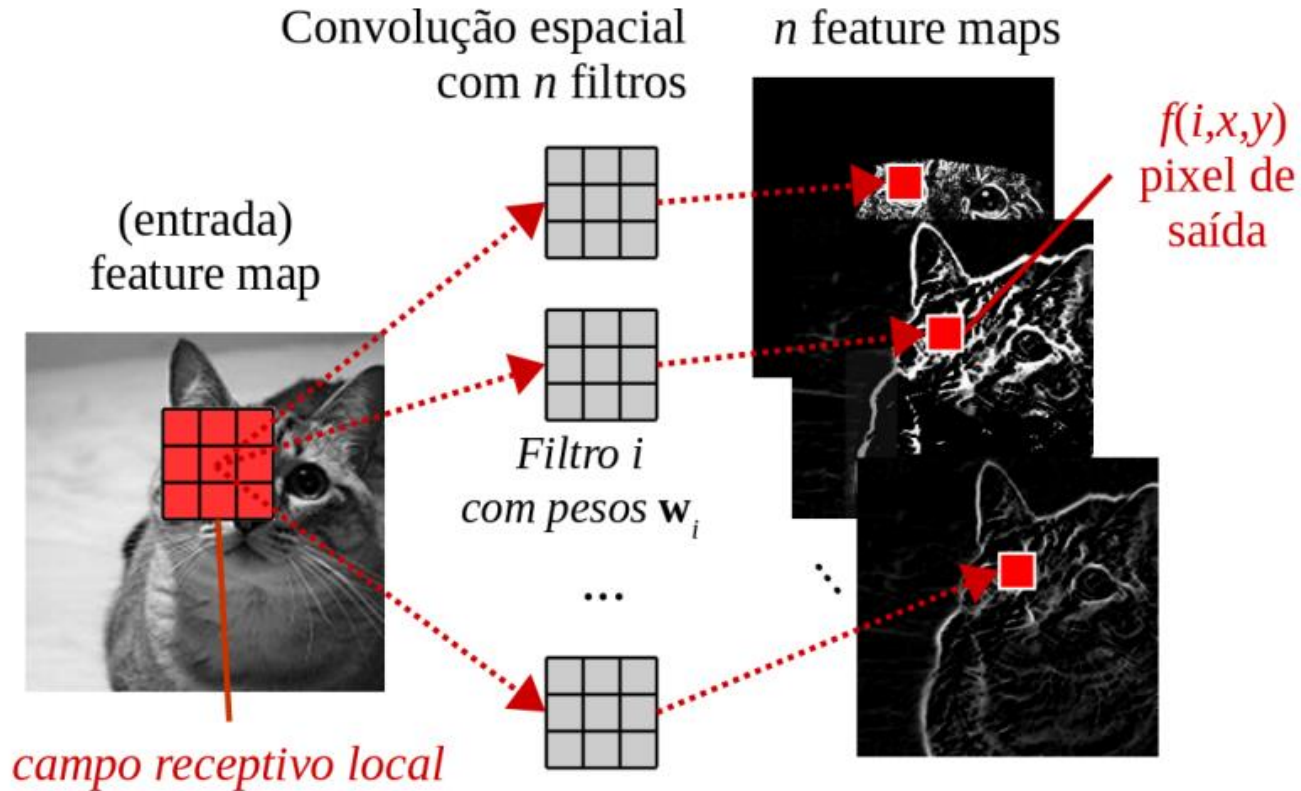
Análise de Características (*Features*)



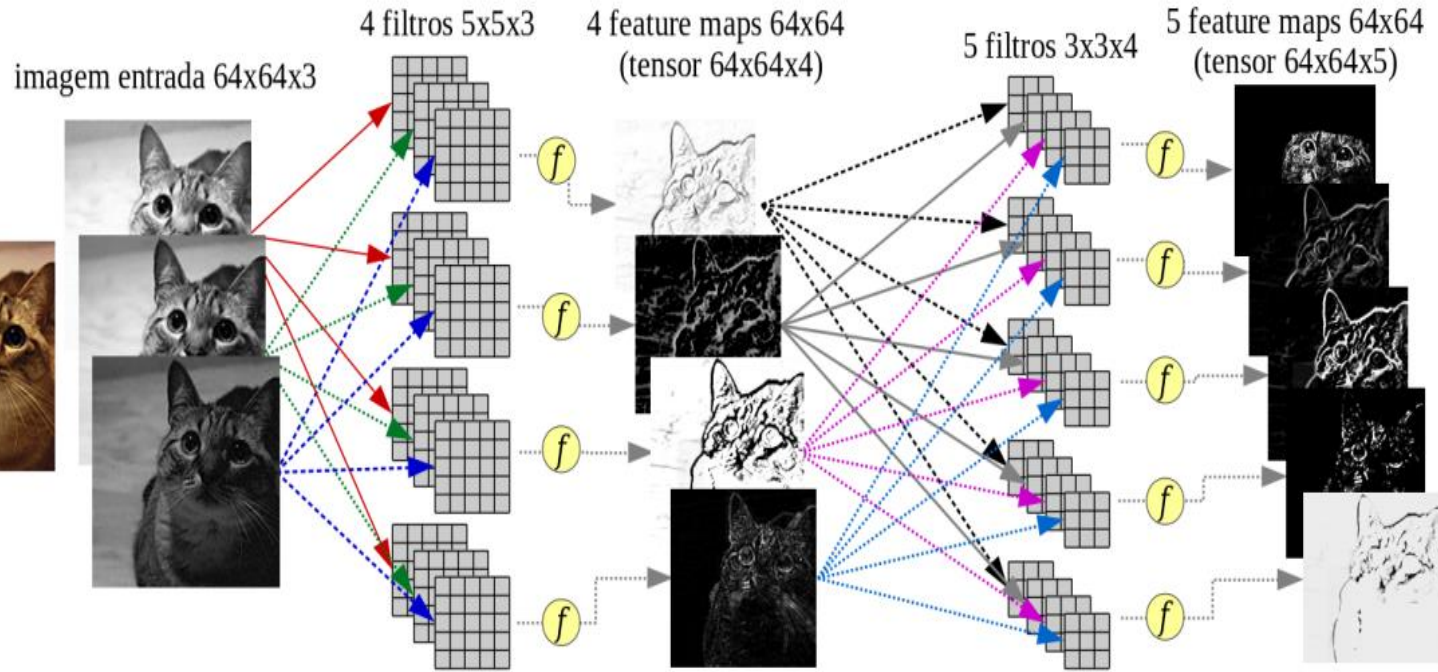
Redes Neurais Artificiais



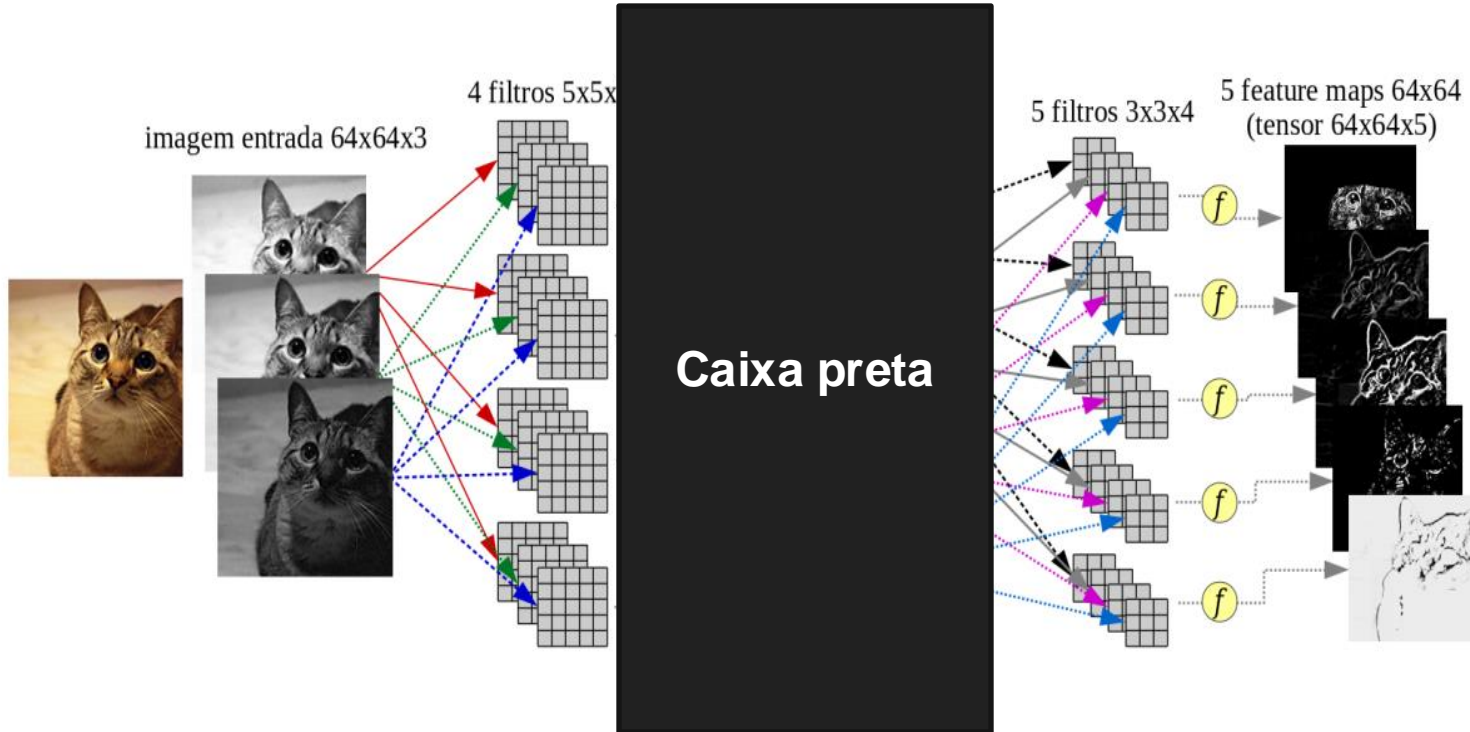
Dados a serem interpretados



Análise de características (*features*)



Caixa preta gerada no treino

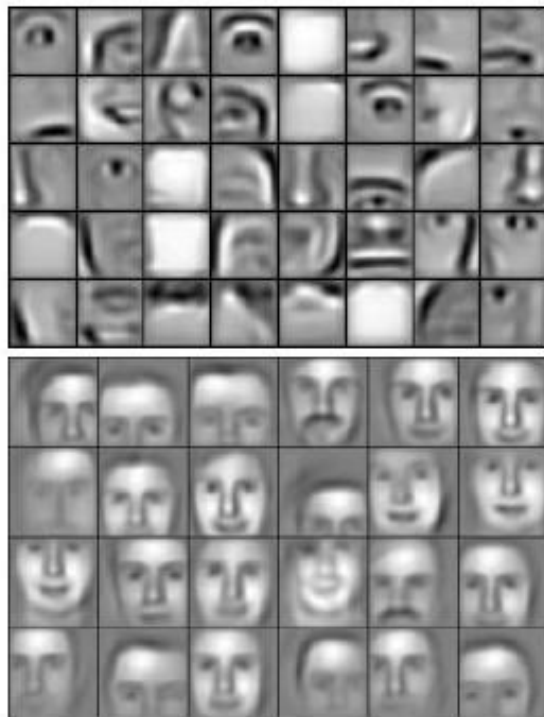


Mas como são as *Features*?

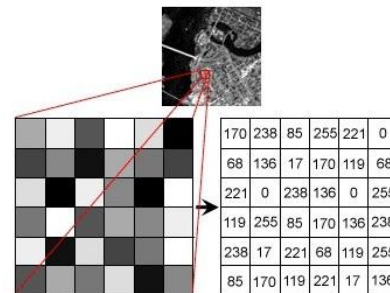
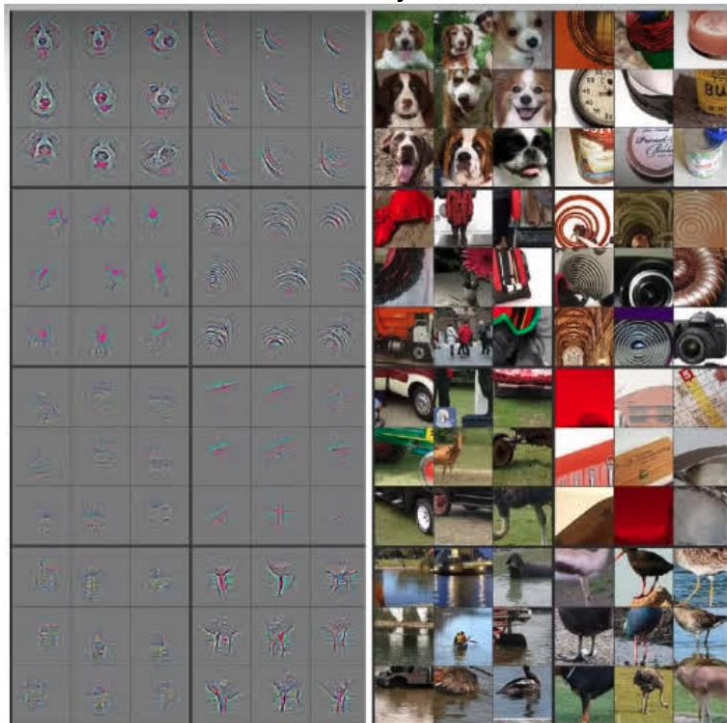


Como são as *features*?

faces



Outros Objetos



$$\begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & \cdots & a_{mn} \end{pmatrix}$$

Classificação



Classificação de objetos



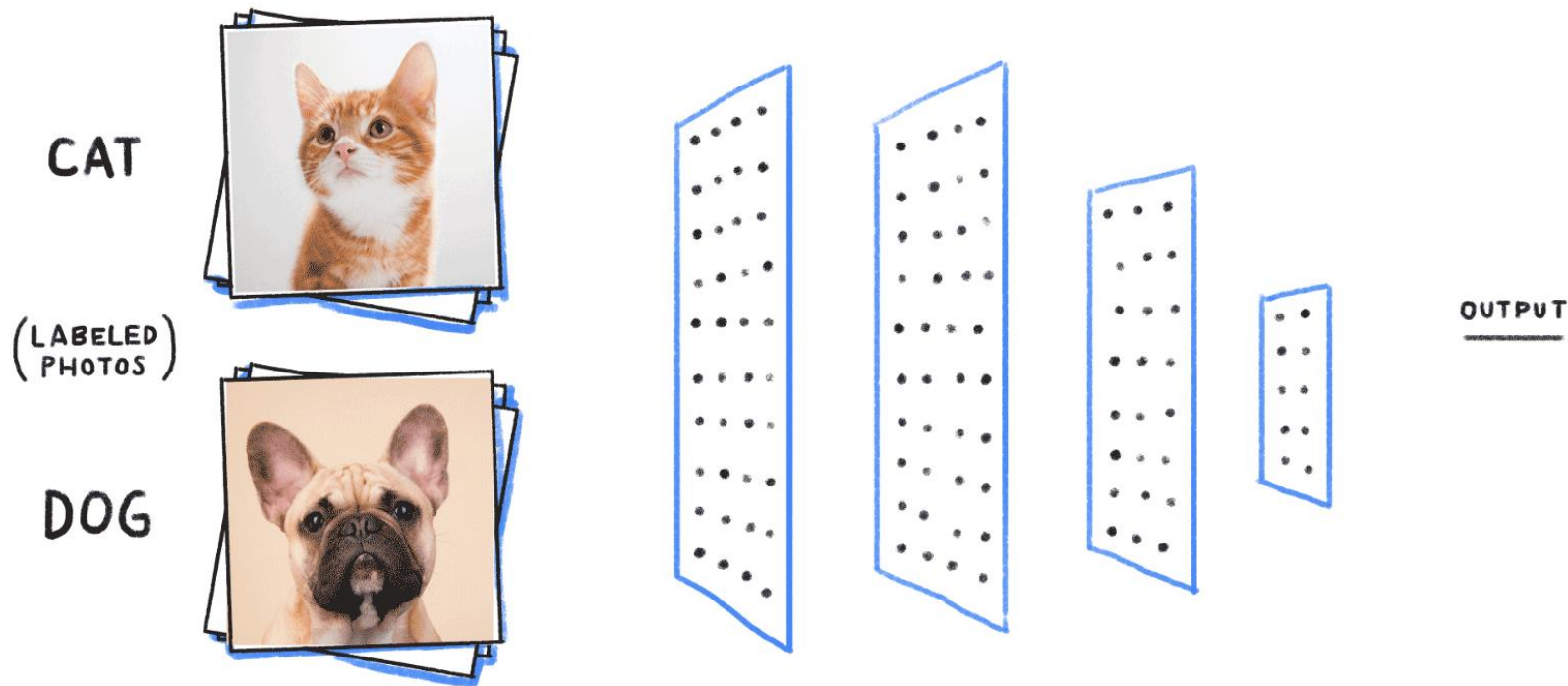
CAT

Aqui temos duas
classes



NOT CAT

Dados a serem interpretados



Dados a serem interpretados

Entrada

Rótulo

Classificação



CAT



NOT CAT



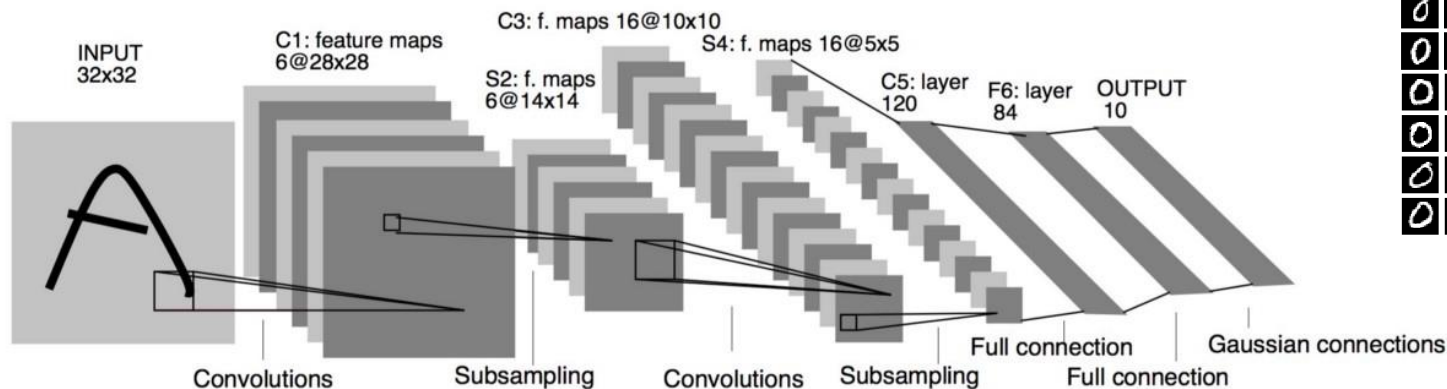
?



CAT

Classificação de objetos

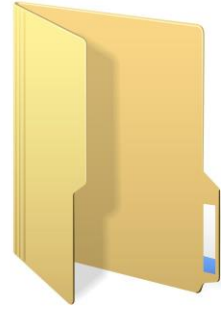
Mnist Dataset



0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9

Aqui temos 9 classes

DATASET – Base de treino



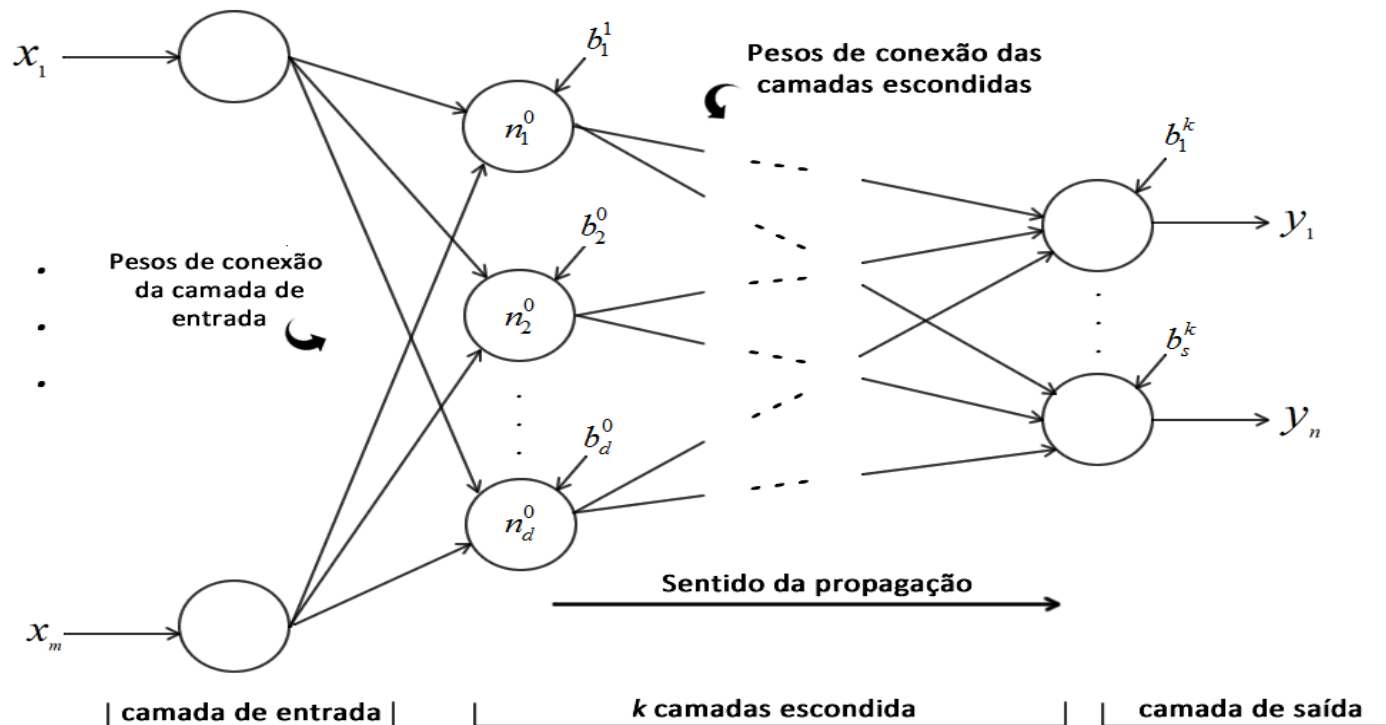
Classe “gatos”

Mas o que gera um Treinamento?



Dados de aprendizado

Pesos gerados no treinamento



Dados de aprendizado

Arquivos de pesos

Protótipo - Rede Neural Artificial

Efetuar treinamento Erro Total: 0,051603300438941

Entrada 01

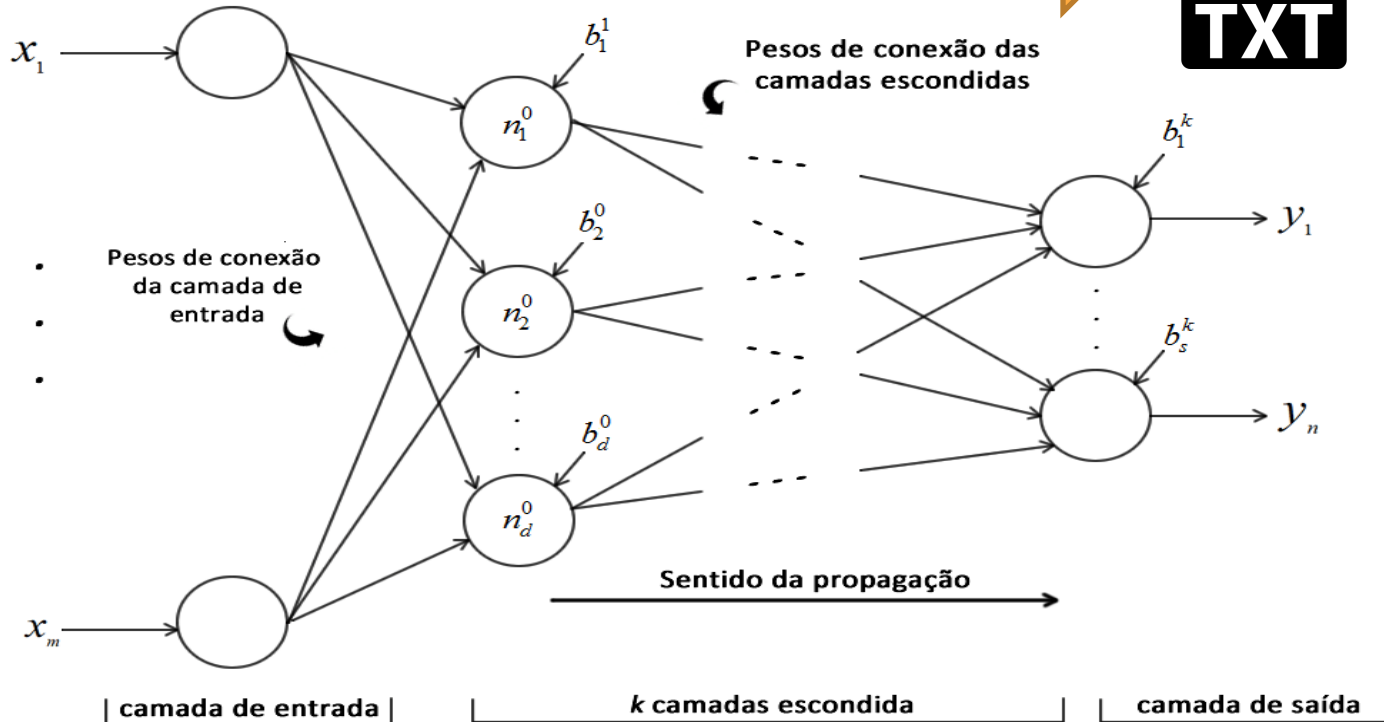
E01	E02	E03	E04	E05	E06	E07	E08
0	1	3	30	0	2000	2	3

Run



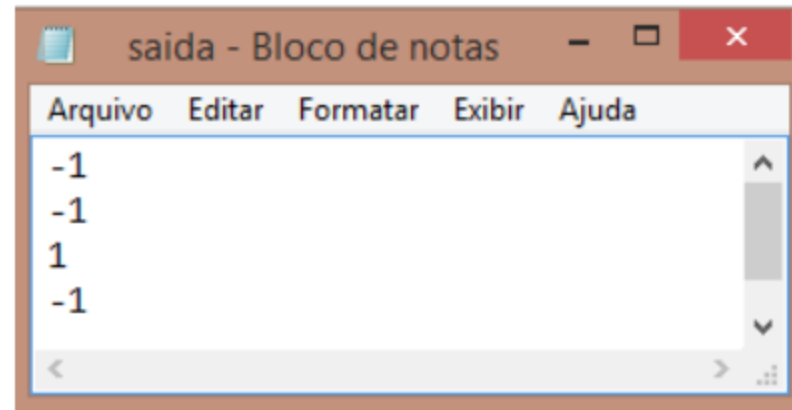
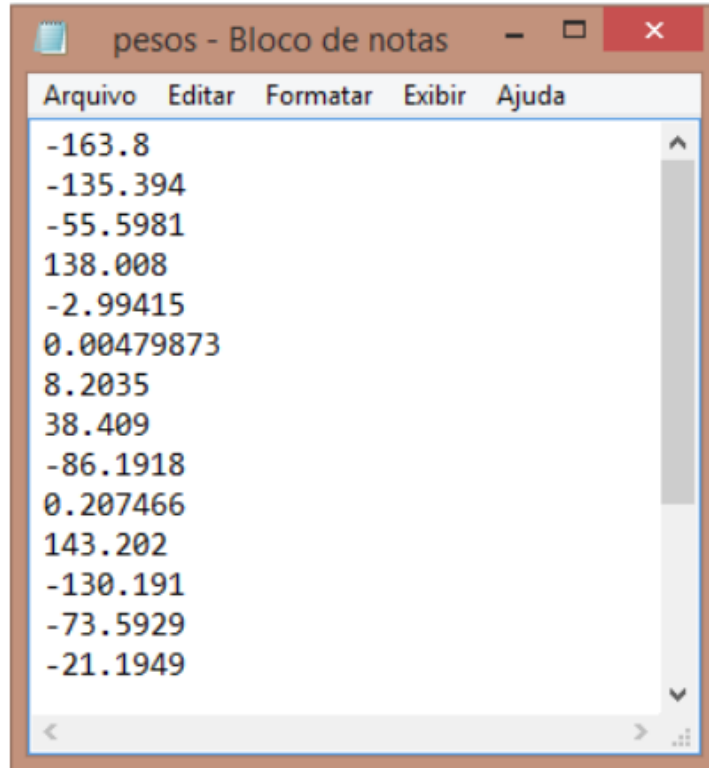
Modelo de treinamento

Arquivos de pesos



Modelo de treinamento

Pesos gerados em uma rede

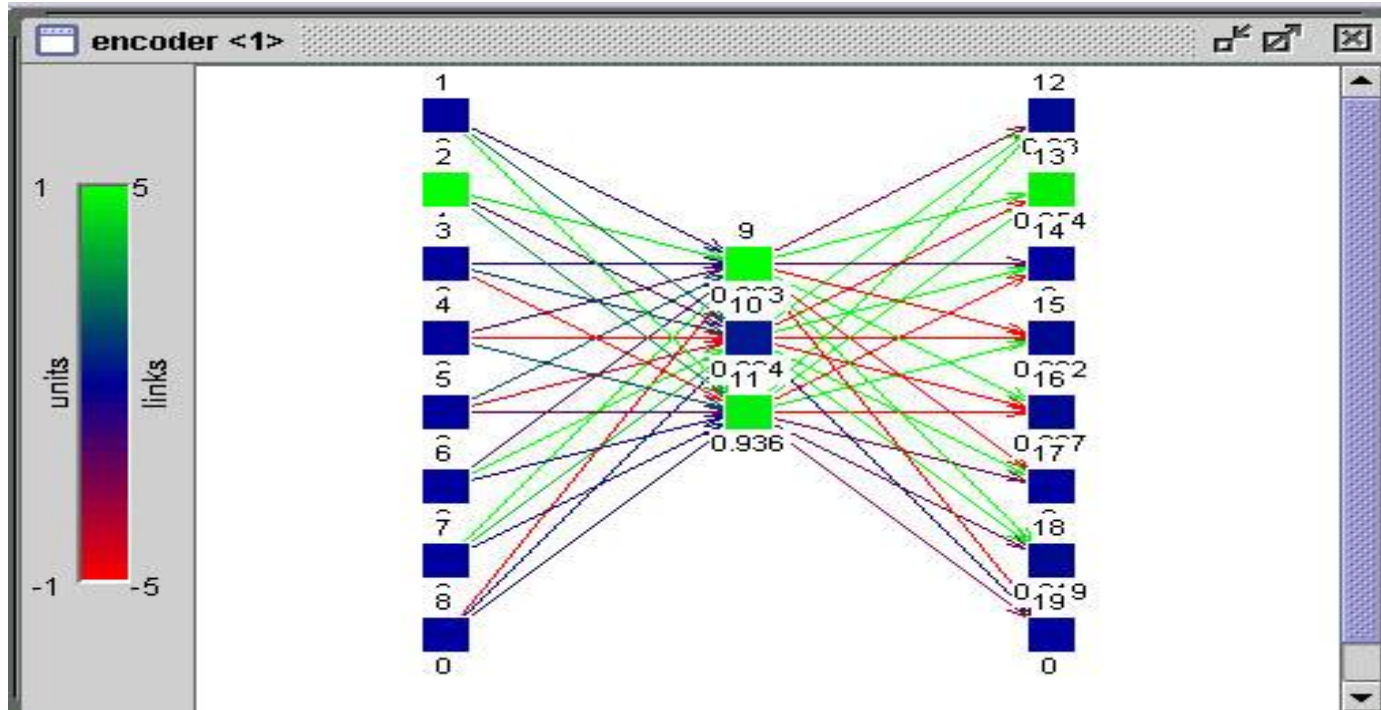


Algoritmo



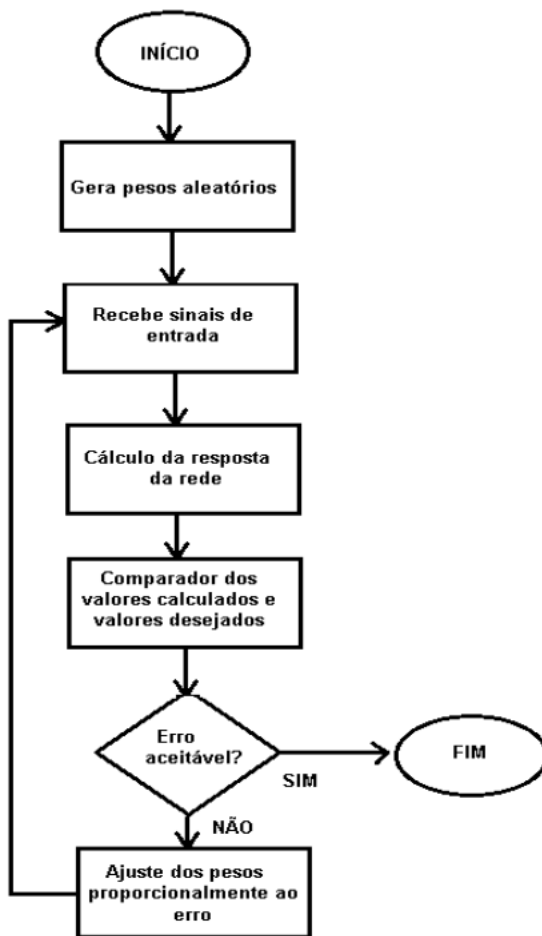
Modelo de treinamento

Relação dos pesos



Algoritmo

```
31 def __init__(self, settings):
32     self.file = None
33     self.fingerprints = set()
34     self.logdups = True
35     self.debug = debug
36     self.logger = logging.getLogger(__name__)
37     if path:
38         self.file = open(os.path.join(path, 'requests.json'),
39                          'a')
40         self.file.seek(0)
41         self.fingerprints.update(repr(r) for r in self.requests)
42
43 @classmethod
44 def from_settings(cls, settings):
45     debug = settings.getbool('debug', False)
46     return cls(job_dir(settings), debug)
47
48 def request_seen(self, request):
49     fp = self.request_fingerprint(request)
50     if fp in self.fingerprints:
51         return True
52     self.fingerprints.add(fp)
53     if self.file:
54         self.file.write(fp + os.linesep)
55
56 def request_fingerprint(self, request):
57     return request_fingerprint(request)
```



Importando Modelos de RNA



Classify ImageNet classes with ResNet50

```
from tensorflow.keras.applications.resnet50 import ResNet50
from tensorflow.keras.preprocessing import image
from tensorflow.keras.applications.resnet50 import preprocess_input, decode_predictions
import numpy as np

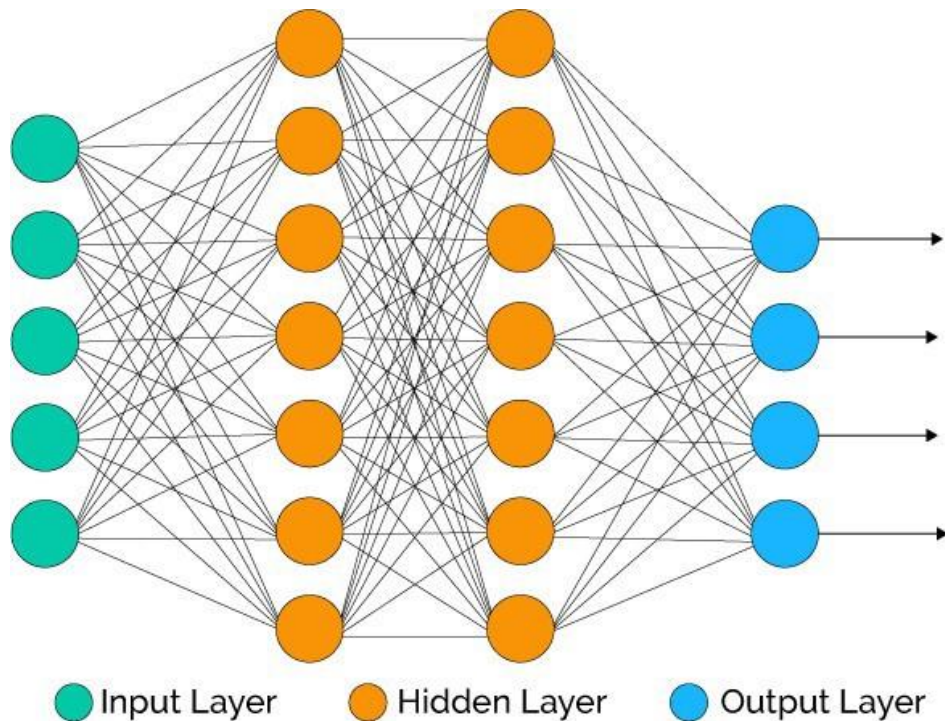
model = ResNet50(weights='imagenet')

img_path = 'elephant.jpg'
img = image.load_img(img_path, target_size=(224, 224))
x = image.img_to_array(img)
x = np.expand_dims(x, axis=0)
x = preprocess_input(x)
```



Keras

Exemplo de RNA no COLAB



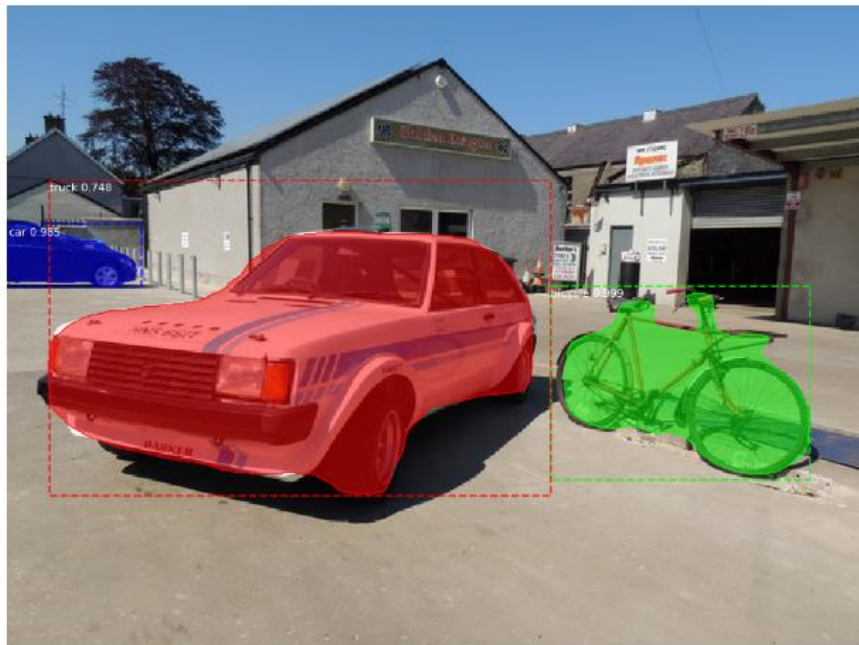
colab

https://colab.research.google.com/github/storopoli/ciencia-de-dados/blob/master/notebooks/Aula_18_a_Redes_Neuralis_com_TensorFlow.ipynb#scrollTo=6zmMUxg8pfqE

Exemplo de RNA no COLAB



```
Processing 1 images
image      shape: (480, 640, 3)    min: 0.00000 max: 255.00000 uint8
molded_images shape: (1, 1024, 1024, 3) min: -123.70000 max: 151.10000 float64
image_metas shape: (1, 93)        min: 0.00000 max: 1024.00000 float64
anchors     shape: (1, 261888, 4)   min: -0.35390 max: 1.29134 float32
```



https://colab.research.google.com/github/tensorflow/tpu/blob/master/models/official/mask_rcnn/mask_rcnn_demo.ipynb#scrollTo=X8rPd4MyrDsn

Obrigado!

Prof. Dr. Diego Bruno

