A Survey on Transfer Learning

by Antonio Leal

Notations and Definitions

Domain (D)

features space *(Y)*

marginal probability distribution *P (X)*

$D = \{Y ; P (X)\}$

Task

label space (Y)

objective predictive function *f(.)*

$Y = \{Y ; f(.)\}$

Subsettings:

- inductive transfer learning
- transductive transfer learning
- unsupervised transfer learning

based on different situations between the source and target domains and tasks.

Subsettings: based on different situations between the source and target domains and tasks.

- inductive transfer learning
  the target task is different from the source task, no matter when the source and target domains are the same or not

- transductive transfer learning
  the source and target tasks are the same, while the source and target domains are different

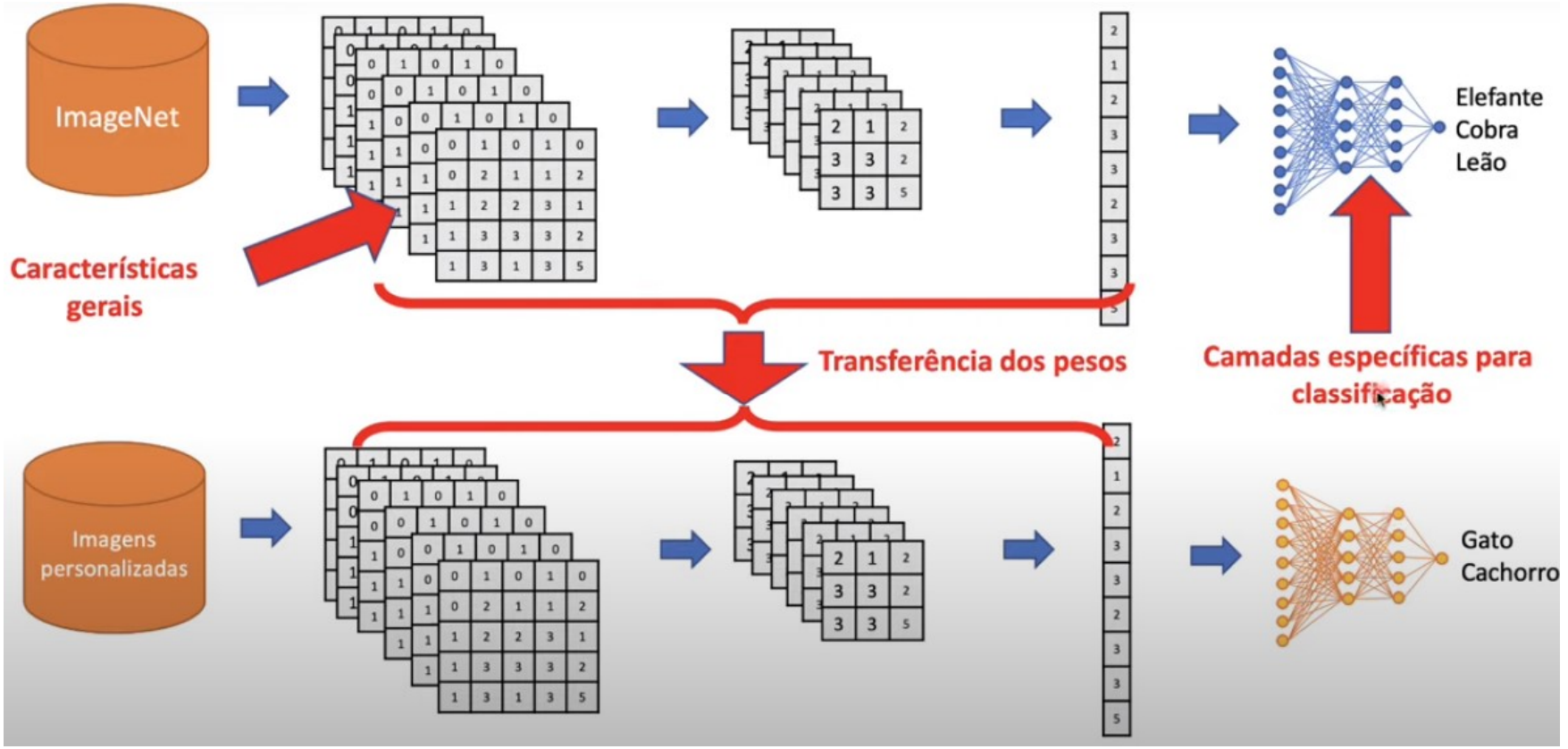
- unsupervised transfer learning
  the target task is different from but related to the source task

Relationship between Traditional Machine Learning and Various Transfer Learning Settings

Learning Settings		Source and Target Domains	Source and Target Tasks
Traditional Machine Learning		the same	the same
Transfer Learning	*Inductive Transfer Learning* / *Unsupervised Transfer Learning*	the same	different but related
		different but related	different but related
	Transductive Transfer Learning	different but related	the same

Settings table

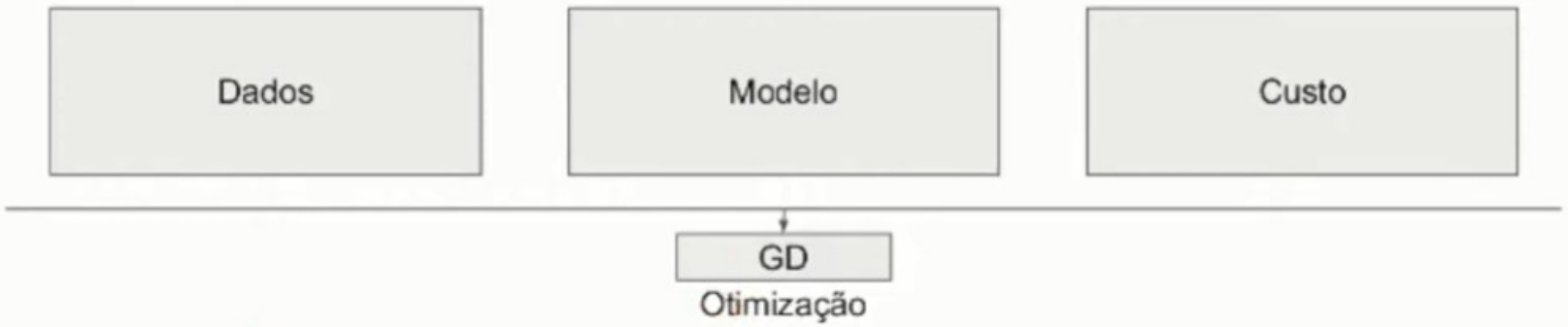
Transfer Learning Settings	**Domain**	**Task**	**Examples**
Inductive	the same	different but related (labels/objective function)	dog and cat classification
Transductive	different but related	the same	document classification, sales forecast
Unsuperviser	different but related	different but related	gans


ImageNet
Características gerais
Elefante
Cobra
Leão
Transferência dos pesos
Camadas específicas para classificação
Imagens personalizadas
Gato
Cachorro

O que é Transfer Learning?

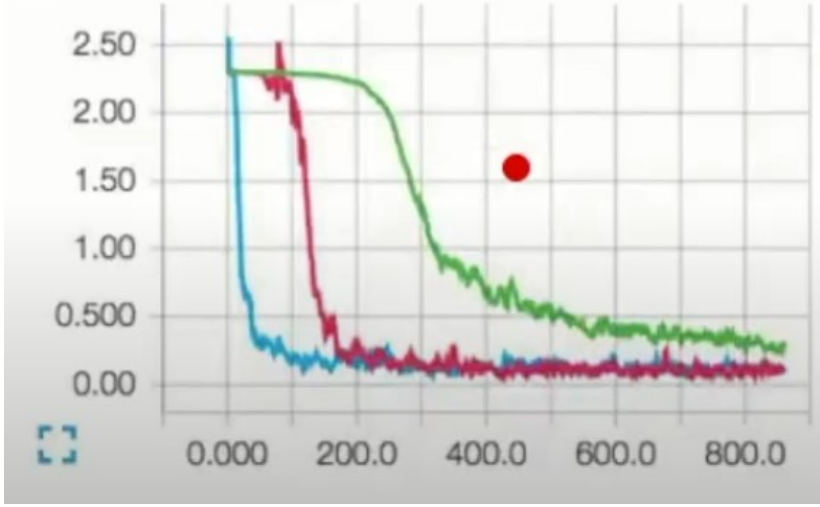
- Tarefa 1: cachorros vs gatos

$$CE = -\sum_{i}^{C} t_i log(s_i)$$

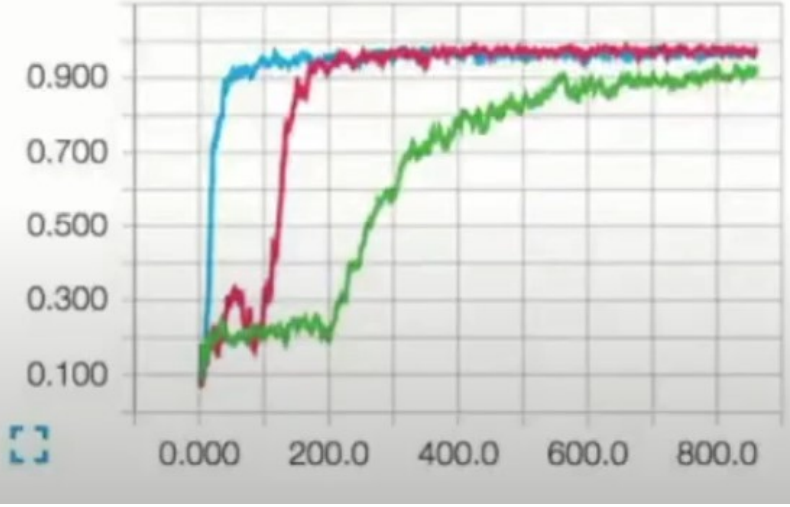


- Tarefa 1: cachorros vs gatos

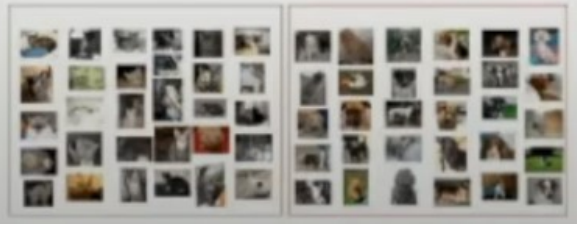
- Loss/



- Accuracy/



Tarefa 2: lobos vs onças



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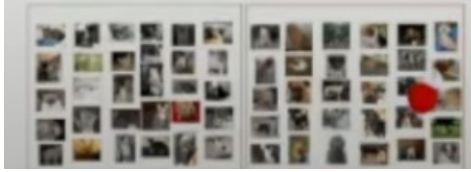
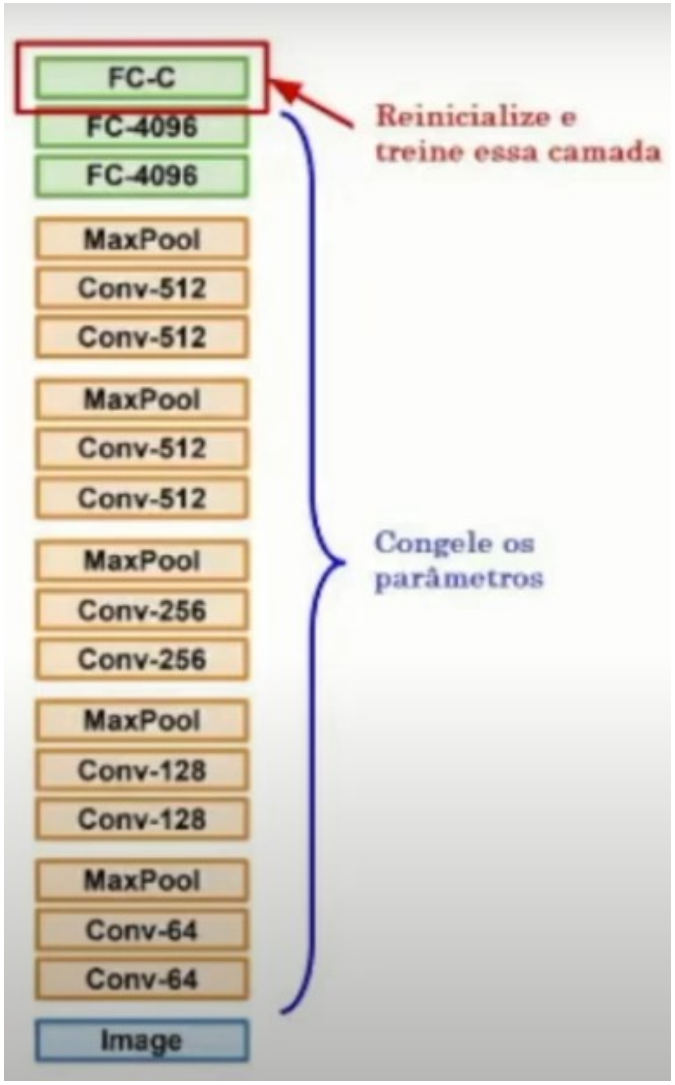
- Tarefa 2: lobos vs onças





- Tarefa 3: elefantes vs ursos

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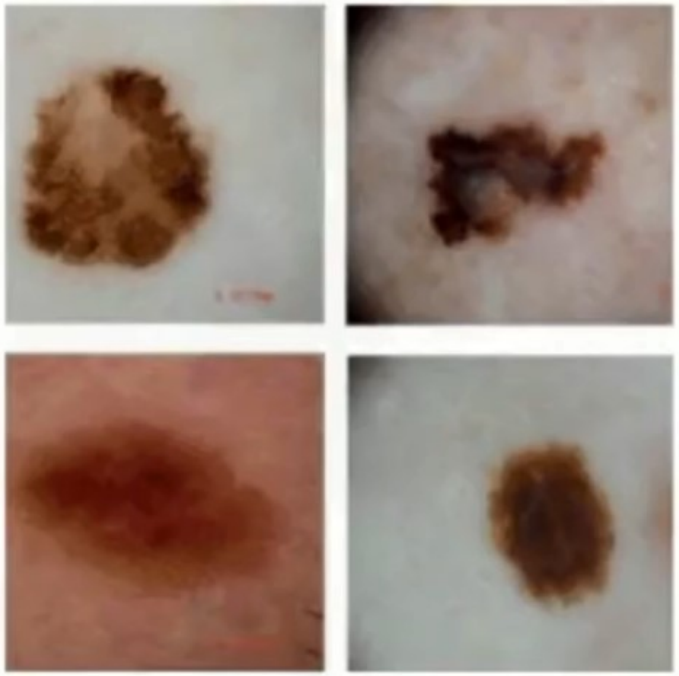
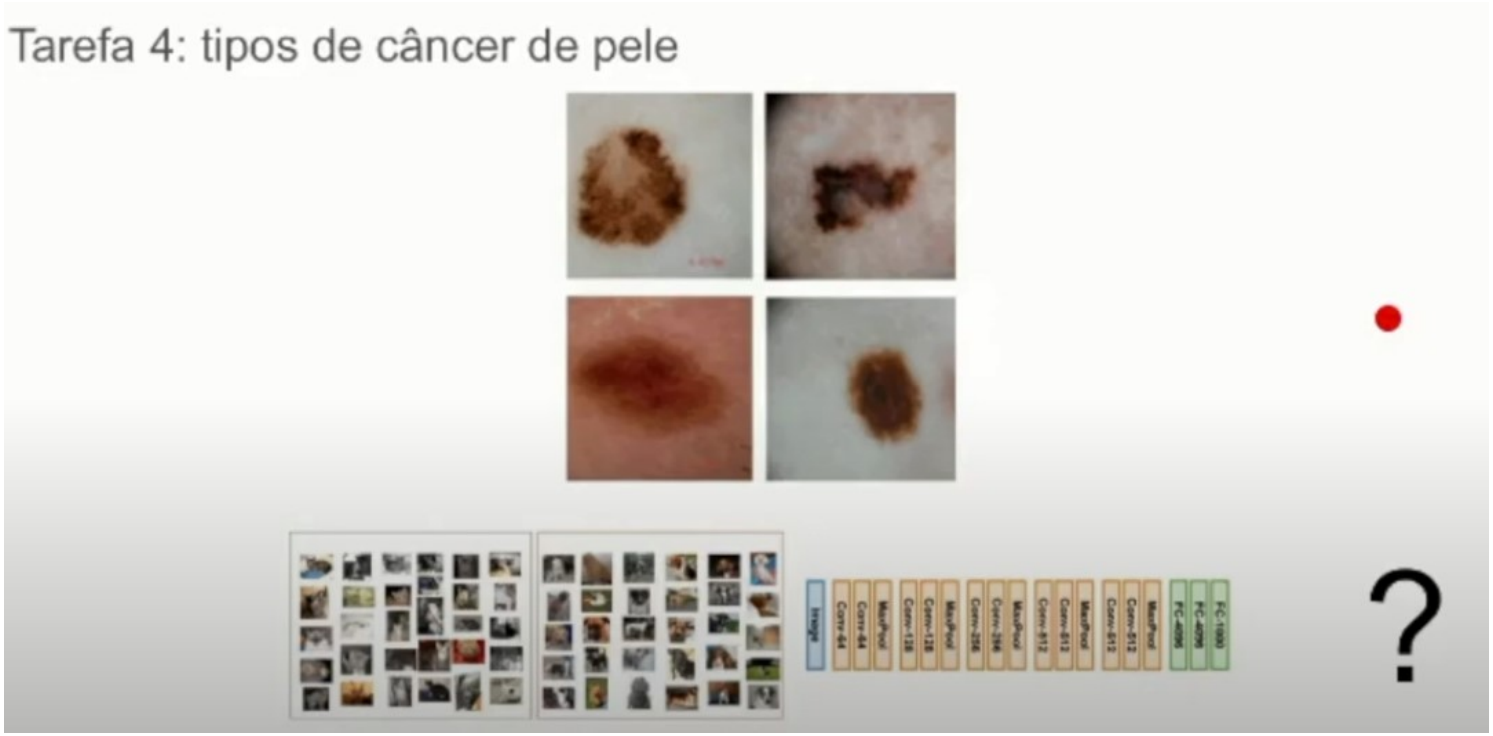
- Tarefa 3: elefantes vs ursos

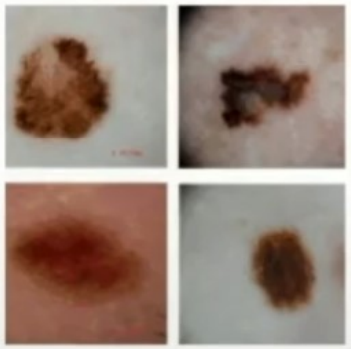
Tarefa 4: tipos de câncer de pele



Tarefa 4: tipos de câncer de pele



- Tarefa 4: tipos de câncer de pele



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Quando usar TL

	Datasets Similares	Datasets Distintos
Muitos dados disponíveis	Treine algumas camadas do modelo base e o classificador de saída	Treine um número maior de camadas (ou todas elas)
Poucos dados disponíveis	Treine apenas o classificador de saída	É... Houston, we have a problem

REFERENCES

- *A Survey on Transfer Learning - Sinno Jialin Pan and Qiang Yang, Fellow*
- *https://www.youtube.com/watch?v=u75cZNS98o0&t=2952s*
- *https://www.youtube.com/watch?v=92AMmjNBEhc*