

13 JANEIRO | 18h30 | Auditório 1

BENEFÍCIOS DO REINFORCEMENT LEARNING NOS DISPOSITIVOS DA INTERNET DAS COISAS


ORADOR
Laercio Cruvinel

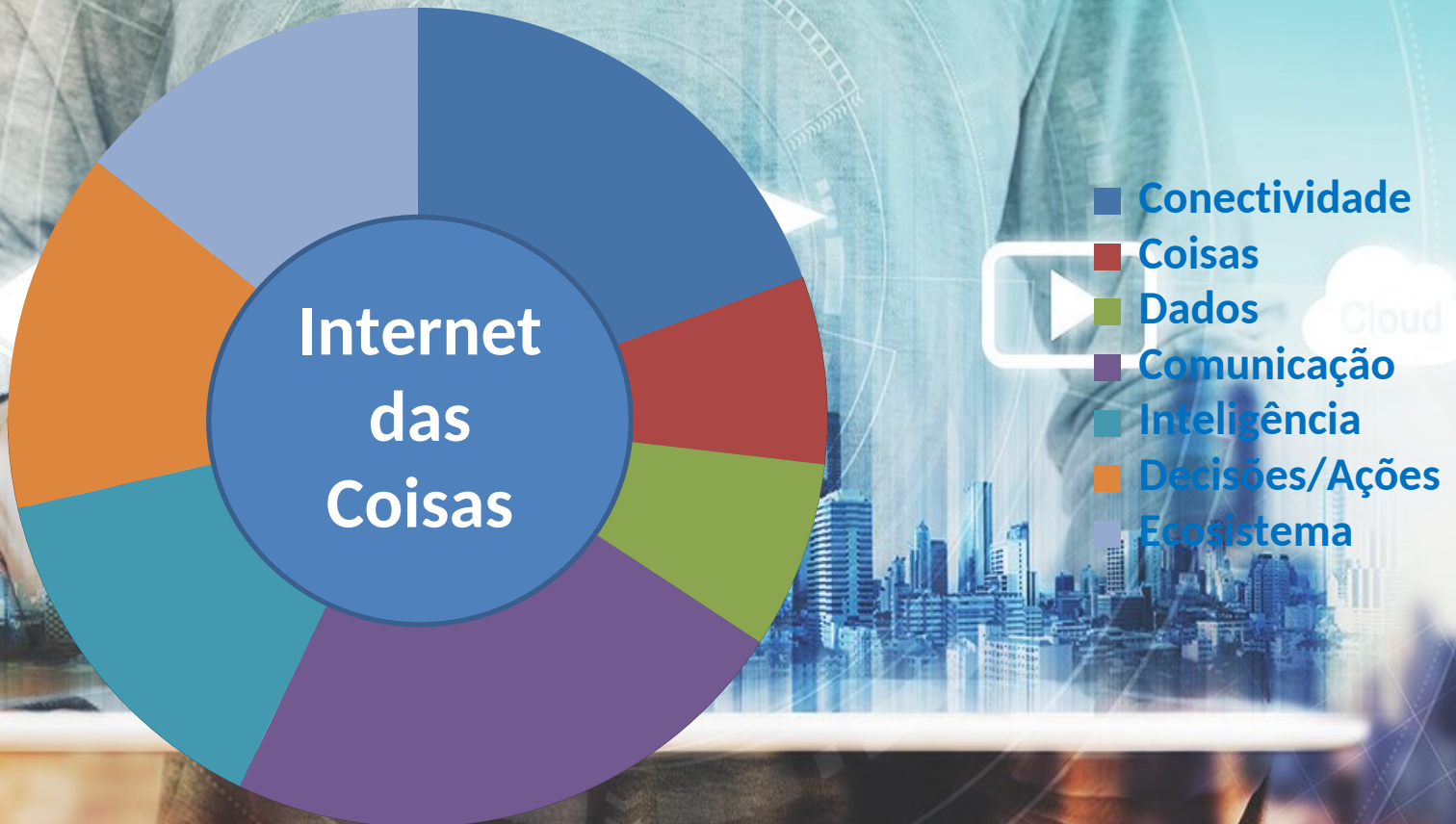


Vamos Falar Sobre

- A Internet das Coisas (IoT)
- Novos Paradigmas de Comunicação
- Aprendizagem de Máquina (ML)
- Benefícios do *Reinforcement Learning* (RL)
- Casos de Estudo
- Ferramentas de Aprendizagem e Teste

A Internet das Coisas

Características da Internet das Coisas



Tendências da IoT

- Elevado crescimento (~70 mil milhões 2025)



Fonte:
financeonline.com

- Soluções e dispositivos de **Edge Computing**



Desafios da IoT

- Tráfego de dados e sinalização
- RATs (*Radio Access Technologies*) muito específicas para baixo consumo e baixa largura de banda



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Inteligência no *Edge*

- **Maior eficiência operacional**
 - Otimização dos processos de negócio
- **Evita problemas de latência**
 - Menor processamento dos dados na nuvem
- **Realizar análise preditiva**
 - Identificação de problemas potenciais
- **Maior segurança**
 - Distanciamento da infraestrutura de nuvem pública

Paradigmas de Aprendizagem

- **Aprendizagem Supervisionada**
 - Utiliza dados conhecidos para fazer previsões
 - Ex: Classificação, Regressão
- **Aprendizagem Não Supervisionada**
 - Encontra padrões pouco evidentes
 - Ex: *Clustering*, Associação
- **Reinforcement Learning e Deep RL**
 - Utilizada para melhorar a eficiência adaptando o comportamento do sistema
 - Procura maximizar uma recompensa



Benefícios da Reinforcement Learning

- Decidir qual RAT utilizar

Suponha a recompensa modelada da seguinte forma:

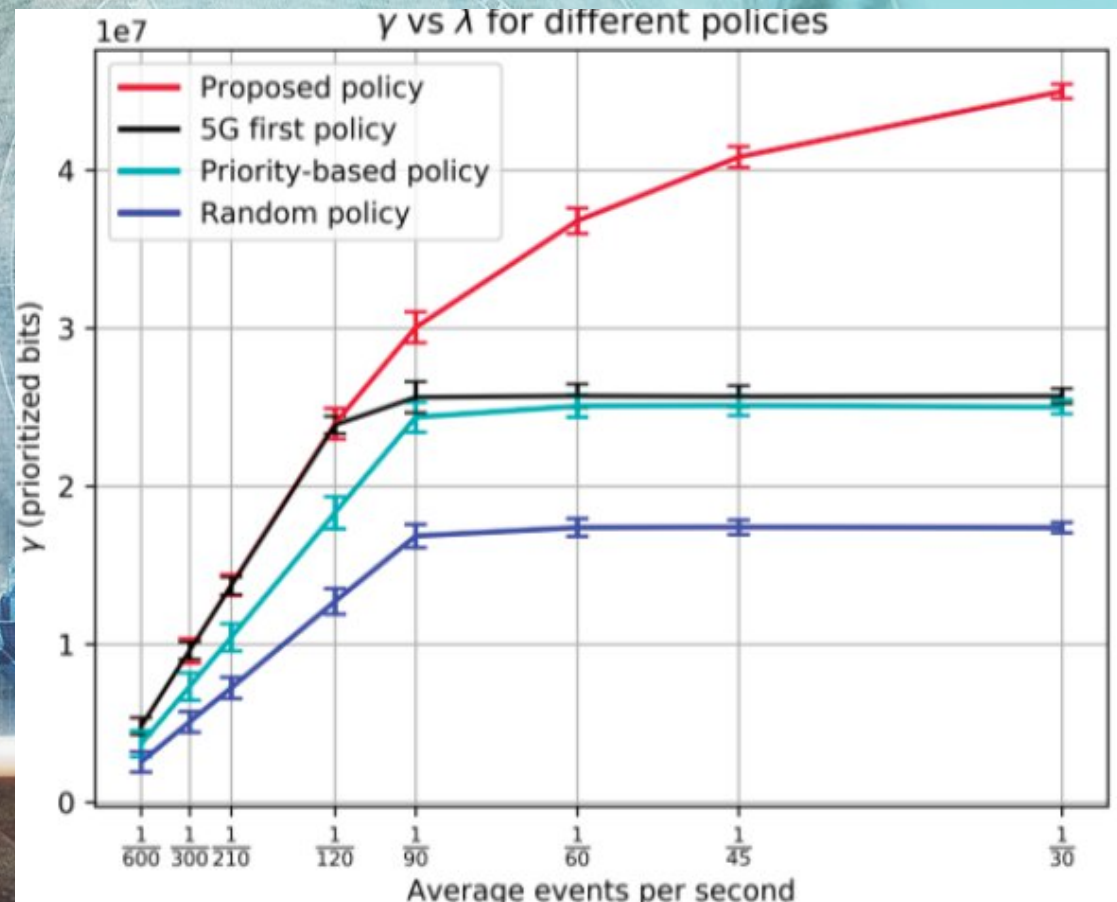
$$R(s, a_i) = G \cdot \frac{L}{\text{atraso}}$$

onde:

G = prioridade do evento

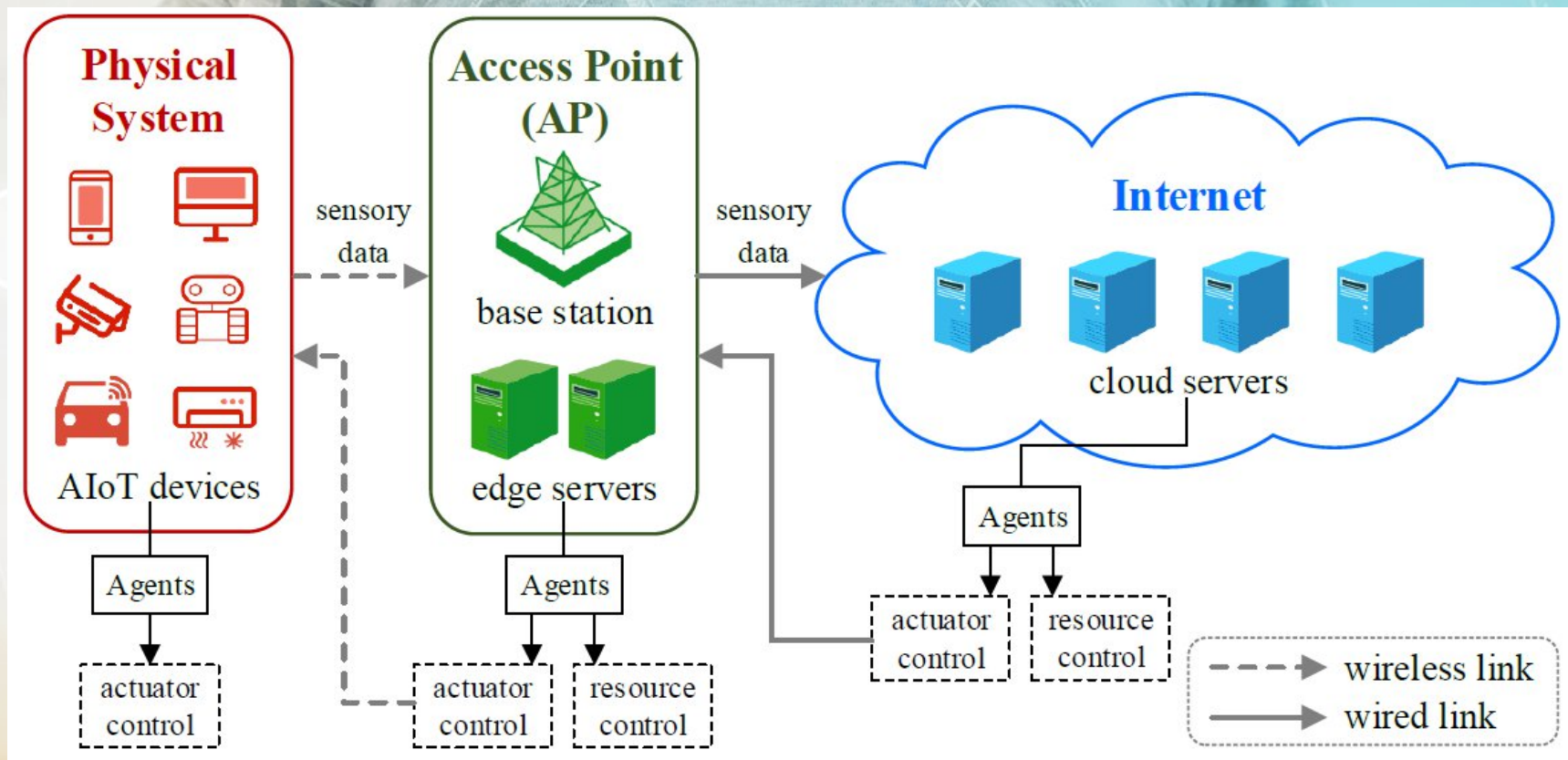
L = tamanho da msg

atraso: atraso da transmissão



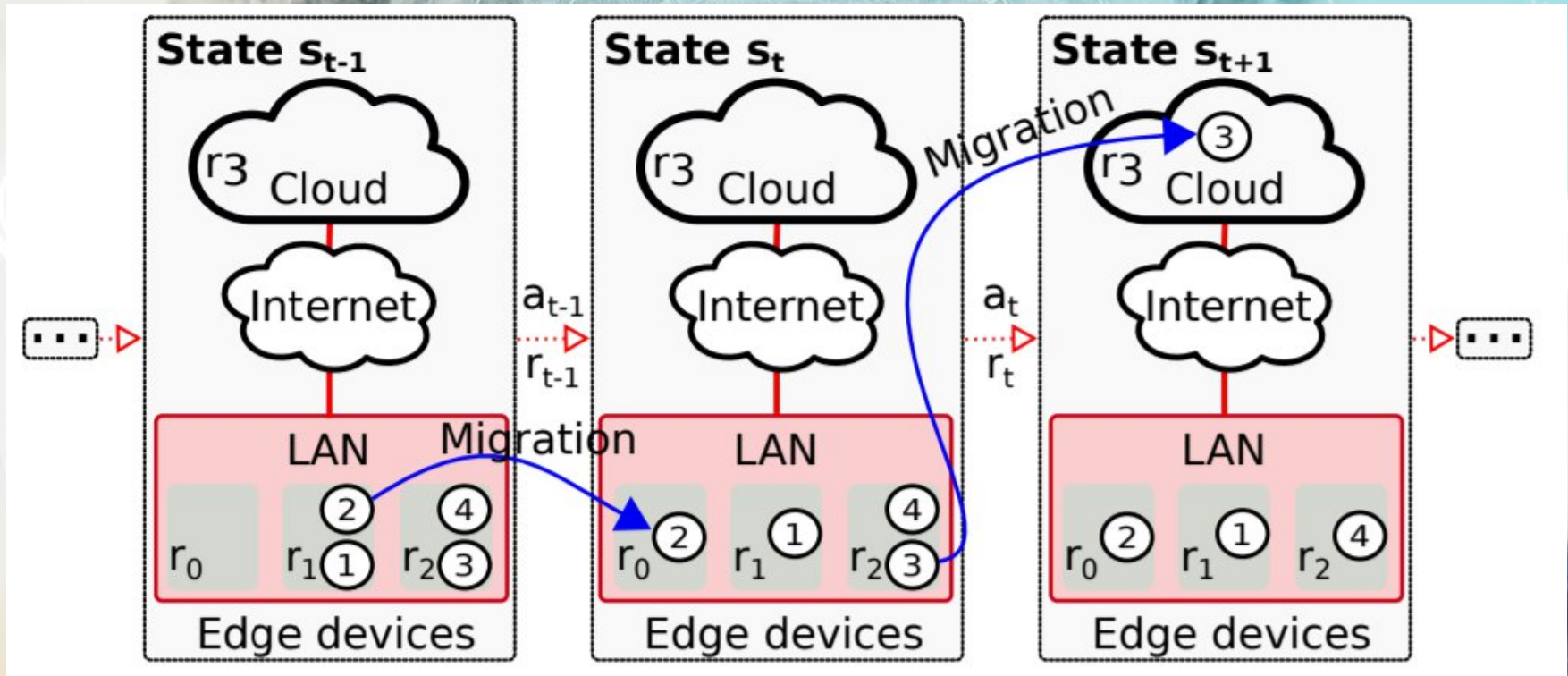
Benefícios do *Reinforcement Learning*

- **Sistemas de controlo autónomos**



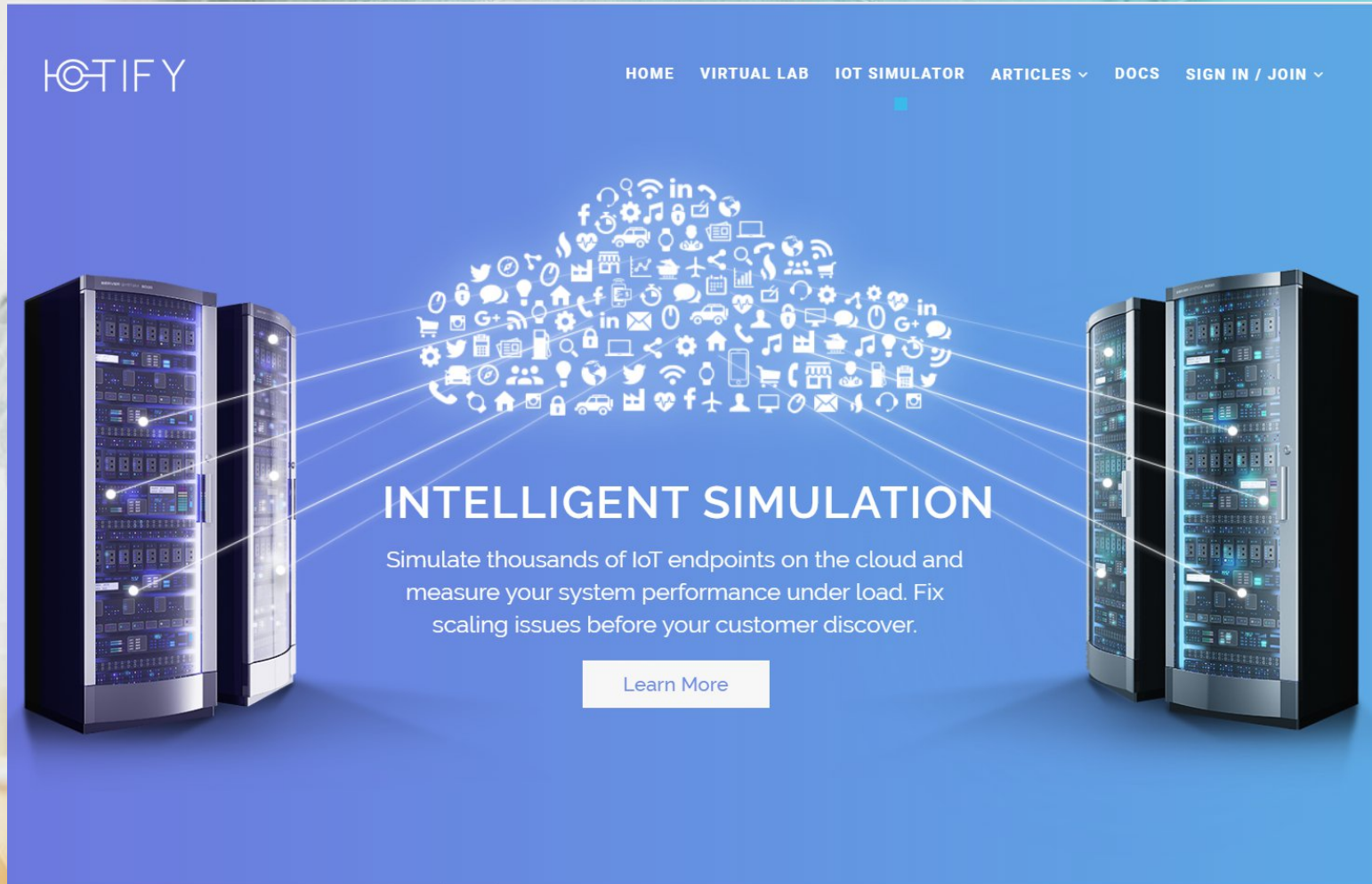
Benefícios do *Reinforcement Learning*

- Distribuição da carga de processamento



Fonte: Veith et al.

Ferramentas: Simulador IoT



The banner features a blue background with a central cloud of white IoT icons (Wi-Fi, car, house, etc.) connected by lines to two server racks on either side. The text 'INTELLIGENT SIMULATION' is prominently displayed in the center, with a descriptive paragraph below it and a 'Learn More' button.

IoTIFY

HOME VIRTUAL LAB IOT SIMULATOR ARTICLES ▾ DOCS SIGN IN / JOIN ▾

INTELLIGENT SIMULATION

Simulate thousands of IoT endpoints on the cloud and measure your system performance under load. Fix scaling issues before your customer discover.

[Learn More](#)

Ferramentas: Suporte na Nuvem

Google Cloud IoT

Unlock business insights from your global device network with an intelligent IoT platform.

Platform for intelligent IoT services

Google Cloud IoT is a complete set of tools to connect, process, store, and analyze data both at the edge and in the cloud. The platform consists of scalable, fully-managed cloud services; an integrated software stack for edge/on-premises computing with machine learning capabilities for all your IoT needs.



Track your assets
all over the globe
vagabond
mobile. vending. operations.

Oden Technologies: Optimizing
production on the factory floor

Ferramentas: Dispositivos IoT

Google Cloud IoT- ready hardware

Google and its partners offer devices and prototyping kits that simplify integration and make it easy to connect to the Google Cloud Platform. And with fully managed IoT services like Cloud IoT Core you can securely connect, manage, and ingest data from globally dispersed devices.



IoT Developer Prototyping Kits



IoT Edge Devices



Ferramentas: Software ML

 PyTorch

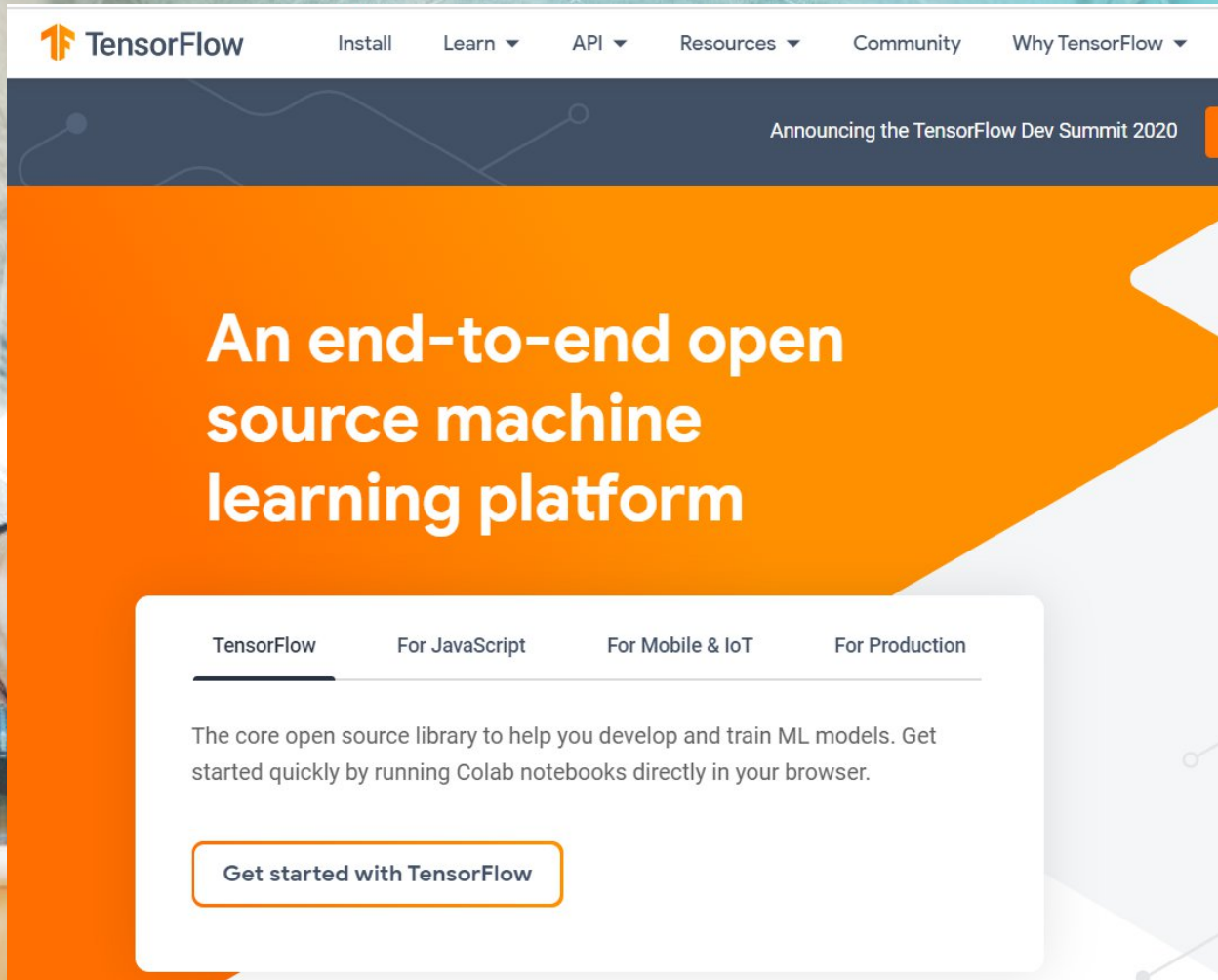
Get Started

Ecosystem

FROM RESEARCH TO PRODUCTION

An open source machine learning framework that accelerates the path from research prototyping to production deployment.

Ferramentas: Software ML



The screenshot shows the TensorFlow website. At the top is a navigation bar with the TensorFlow logo and links for Install, Learn, API, Resources, Community, and Why TensorFlow. Below this is a dark blue banner announcing the TensorFlow Dev Summit 2020. The main content area has a large orange arrow pointing right, containing the text 'An end-to-end open source machine learning platform'. Below this is a white box with four tabs: TensorFlow (selected), For JavaScript, For Mobile & IoT, and For Production. The selected tab contains the text 'The core open source library to help you develop and train ML models. Get started quickly by running Colab notebooks directly in your browser.' and a 'Get started with TensorFlow' button. To the right of the website screenshot, there is a faint background image of a city skyline with a cloud labeled 'Cloud'.

TensorFlow

Install Learn API Resources Community Why TensorFlow

Announcing the TensorFlow Dev Summit 2020

An end-to-end open source machine learning platform

TensorFlow For JavaScript For Mobile & IoT For Production

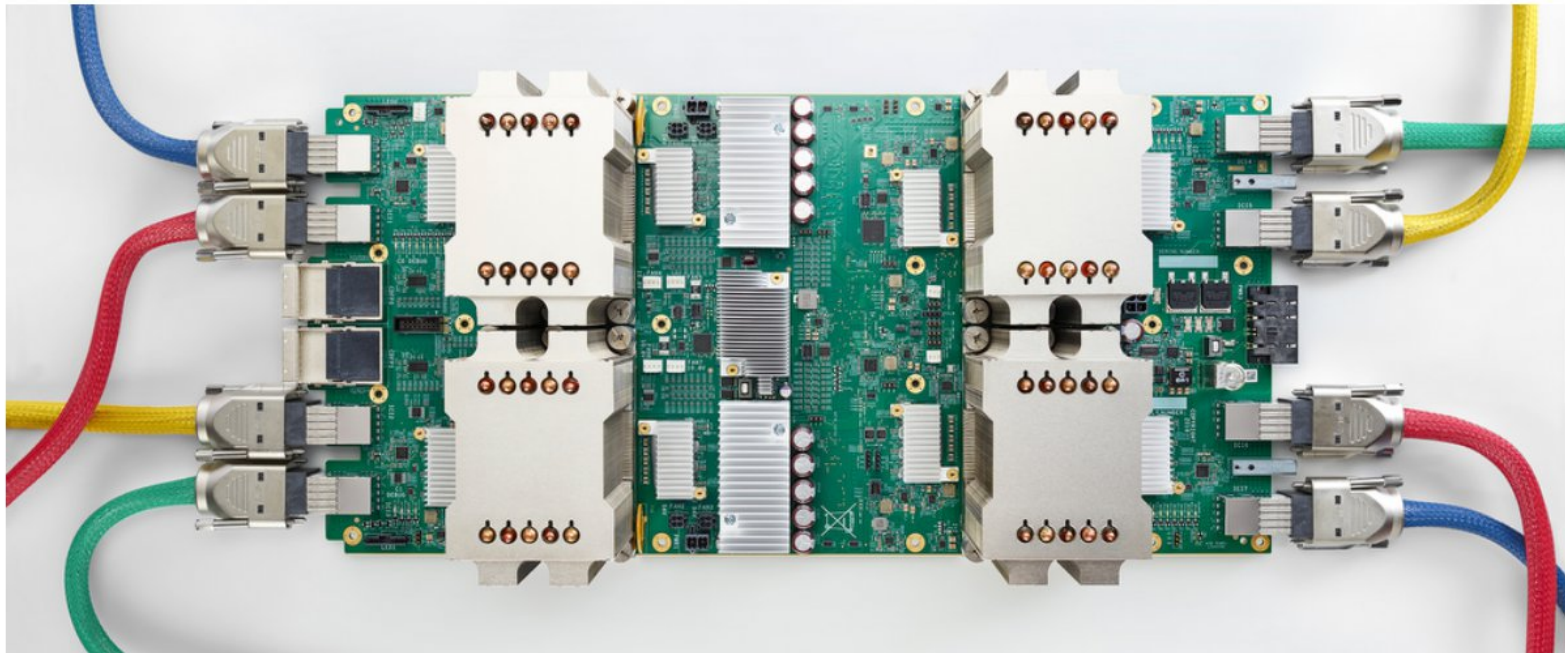
The core open source library to help you develop and train ML models. Get started quickly by running Colab notebooks directly in your browser.

Get started with TensorFlow

Ferramentas: Hardware ML

GOOGLE CLOUD

Build and train machine learning models on our new Google Cloud TPUs



Ferramentas: Tutoriais ML



Welcome To Colaboratory

File Edit View Insert Runtime Tools Help

+ Code + Text

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Table of contents

Code snippets

Files



Introducing Colaboratory

Getting Started

More Resources

Machine Learning Examples: Seedbank

+ Section

Machine Learning Crash Course

These are a few of the notebooks from Google's online Machine Learning course.

- [Intro to Pandas](#)
- [Tensorflow concepts](#)
- [First steps with TensorFlow](#)
- [Intro to neural nets](#)
- [Intro to sparse data and embeddings](#)

Using Accelerated Hardware

- [TensorFlow with GPUs](#)
- [TensorFlow with TPUs](#)

Machine Learning Examples: Seedbank

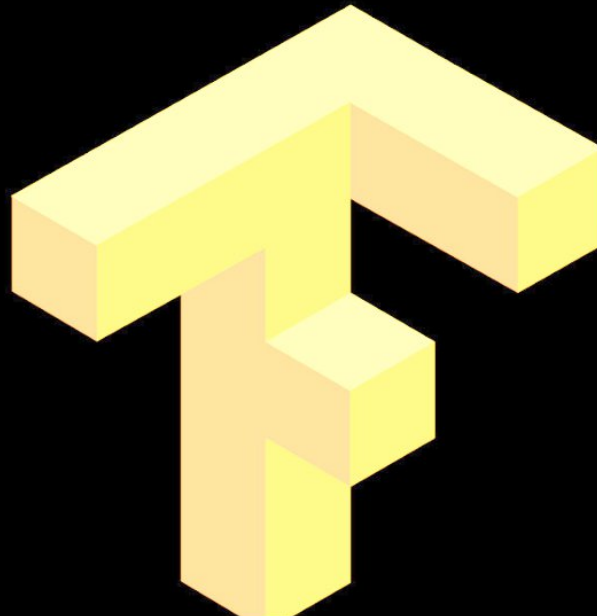
Ferramentas: Tutoriais TensorFlow

Python TensorFlow Tutorial – Build a Neural Network

By Andy | Deep learning

You are here: » [Home](#) » [Deep learning](#) » [Python TensorFlow Tutorial – Build a Neural Network](#)

Apr
08



RECENT POSTS

[Atari Space Invaders and Dueling Q RL in TensorFlow 2](#)

[Dueling Q networks in TensorFlow 2](#)

[Introduction to ResNet in TensorFlow 2](#)

Ferramentas: Tutoriais RL

Reinforcement learning tutorial with TensorFlow

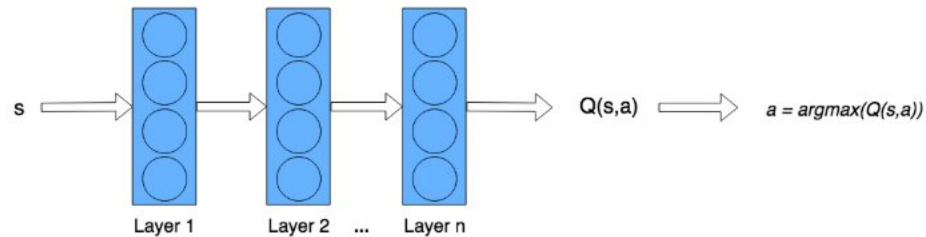
By admin | Reinforcement learning

You are here: » Home » Reinforcement learning » [Reinforcement learning tu](#)

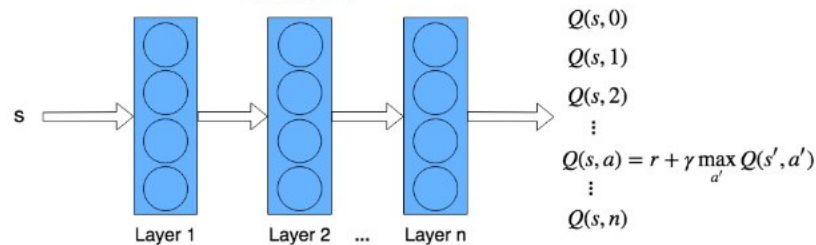
Jul
06

4

Action selection step



Training step



Search...

RECENT POSTS

Atari Space Invaders and Du
TensorFlow 2

Dueling Q networks in Tens

Ferramentas: Tutoriais DRL

A Free course in Deep Reinforcement Learning from beginner to expert.

Some of the agents you'll implement during this course:



Literatura

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- L. Lei, Y. Tan, S. Liu, K. Zheng, X. Shen. *Deep Reinforcement Learning for Autonomous Internet of Things: Model, Applications and Challenges* (2019). Cornell University.
- Thang Le Duc, Rafael García Leiva, Paolo Casari, and Per-Olov Östberg. 2019. *Machine Learning Methods for Reliable Resource Provisioning in Edge-Cloud Computing: A Survey*. ACM Comput. Surv. 52, 5, Article 94 (2019), 39 pages.
- Veith, A, et al. *Multi-Objective Reinforcement Learning for Reconfiguring Data Stream Analytics on Edge Computing* (2019). ICCP '19, Kyoto.
- Chen, Z., & Wang, X. *Decentralized Computation Offloading for Multi-User Mobile Edge Computing: A Deep Reinforcement Learning Approach* (2018). arXiv:1812.07394v1
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- Cruvinel, L. *Dynamic Support to Quality of Service in DiffServ-based IP Networks* (PhD Thesis). Instituto Superior Técnico (2011).