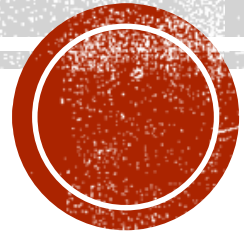
MACHINE LEARNING & PYTHON



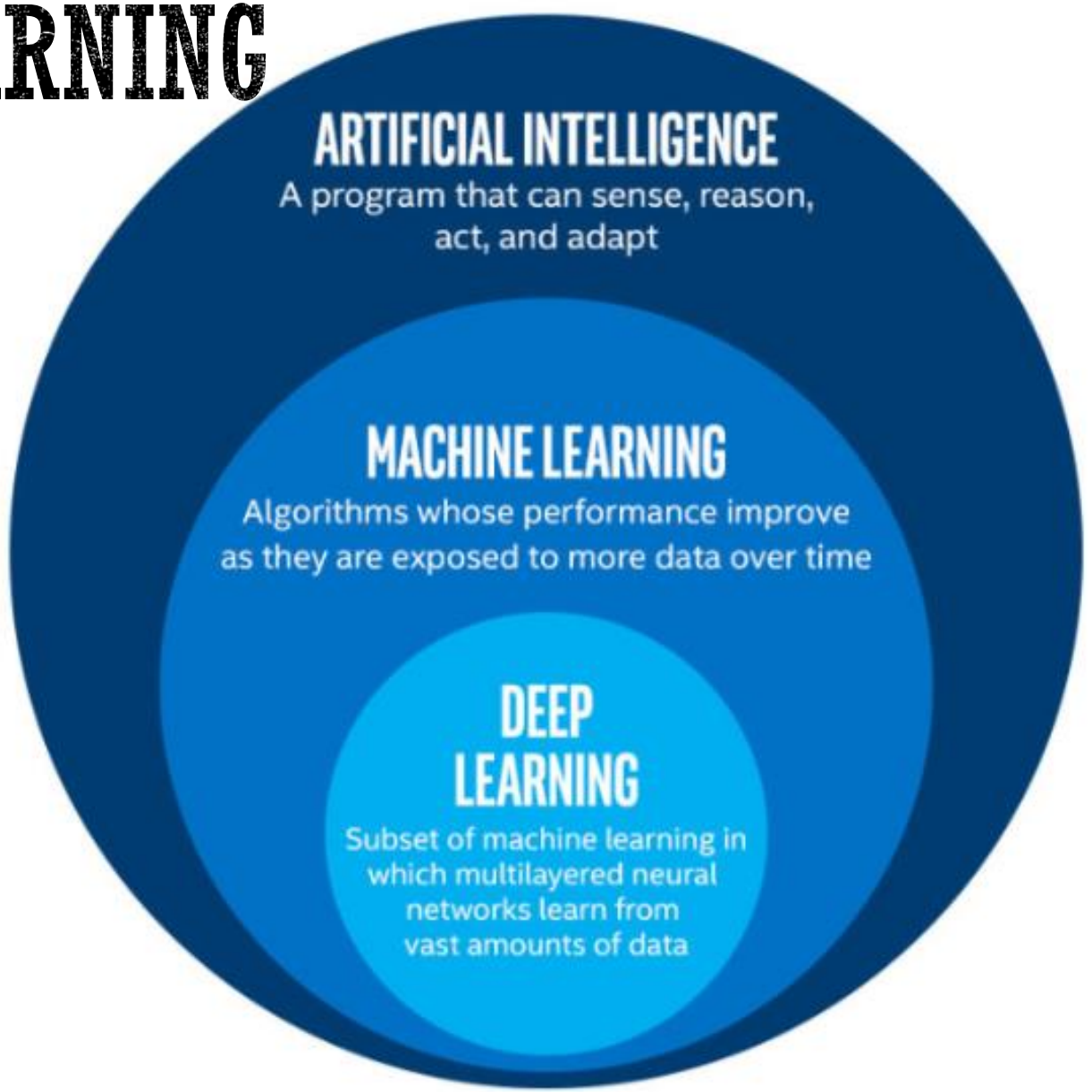
Grupo de estudos PPGERHA

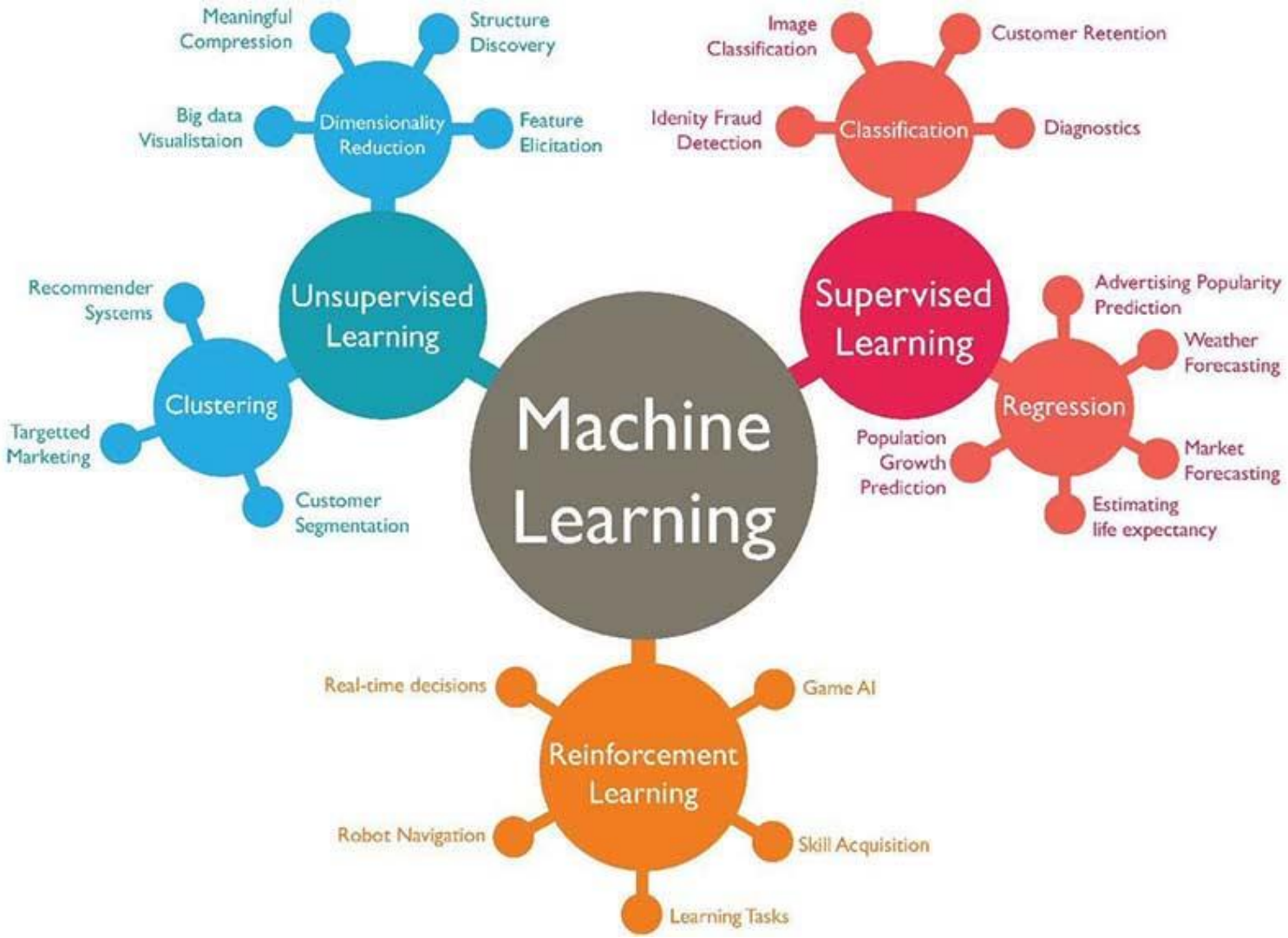
Terças, 17h30 – 19h30

02/04/2019

AI AND MACHINE LEARNING

"Machine learning is a field of computer science that uses statistical techniques to give computer systems the ability to "learn" (e.g., progressively improve performance on a specific task) with data, without being explicitly programmed"




Machine Learning
Unsupervised Learning
Dimensionality Reduction
Meaningful Compression
Structure Discovery
Big data Visualistaion
Feature Elicitation
Clustering
Recommender Systems
Targetted Marketing
Customer Segmentation
Supervised Learning
Classification
Image Classification
Customer Retention
Idenity Fraud Detection
Diagnostics
Regression
Advertising Popularity Prediction
Weather Forecasting
Population Growth Prediction
Market Forecasting
Estimating life expectancy
Reinforcement Learning
Real-time decisions
Game AI
Robot Navigation
Skill Acquisition
Learning Tasks

MACHINE LEARNING

Types of ML

- Supervised Learning
- Unsupervised Learning
- Reinforcement Learning

APLICAÇÕES MACHINE LEARNING EM ENGENHARIA DE RECURSOS HÍDRICOS E AMBIENTAL

Variables	Recent studies
Dam or lake water level	Hipni et al., 2013; Üneş et al., 2015; Li et al., 2016
Evaporation and evapotranspiration	Goyal et al., 2014; Karimi et al., 2016; Güçlü et al., 2017
Rainfall-runoff	Talei et al., 2013; Darras et al., 2015; Londhe et al., 2015; Chithra & Thampi, 2016
Sediment	Demirci and Baltaci, 2013; Güner and Yumuk, 2014; Demirci et al., 2015; Droppo & Krishnappan, 2016; Talebi et al., 2016
Streamflow	Cigizoglu, 2003; Huang et al., 2004; Nourani et al., 2012; Ashrafi et al., 2017
Water quality variables	Ay, 2010; Akkoyunlu et al., 2011; Ay & Kisi, 2011; Ay & Kisi, 2012; Ay & Kisi, 2013a; Ay & Kisi, 2013b; Kisi & Ay, 2013; Ay, 2014; Ay & Kisi, 2014; Chang et al., 2014; Alizadeh & Kavianpour, 2015; Khan & Valeo, 2015; Ay & Kisi, 2017

APLICAÇÕES MACHINE LEARNING EM ENGENHARIA DE RECURSOS HÍDRICOS E AMBIENTAL

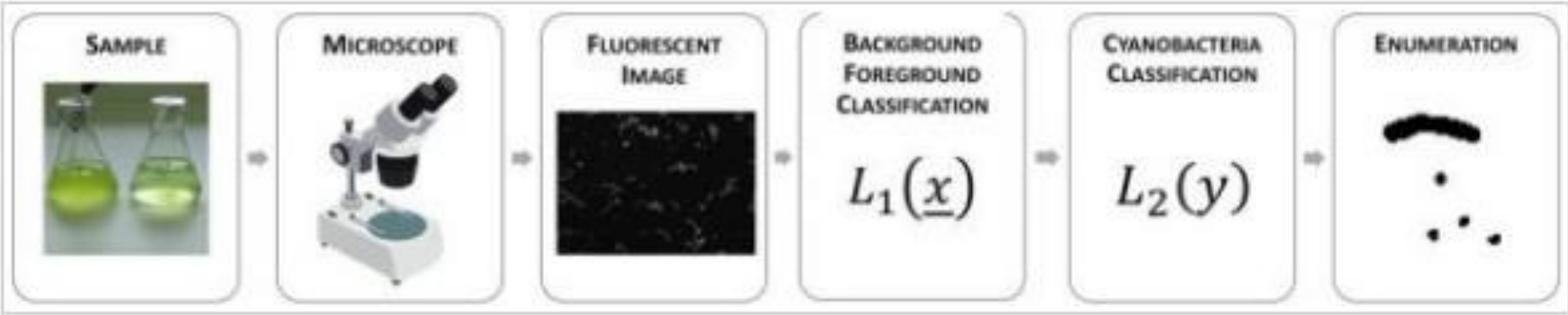
Clima, Hidrologia, Hidráulica, Energia

- Preenchimento de falhas em séries temporais
- Detecção de anomalias em dados
- Previsão de séries temporais
- Otimização de sistemas de energia
- Melhoria de modelos climáticos globais
- Melhoria da previsão climática
- *Downscaling* de modelos globais
- Mudanças climáticas
- Auxílio na tomada de decisão
- Mecânica dos Fluidos (CDF) (Rabault, 2018 – presentation)

APLICAÇÕES MACHINE LEARNING EM ENGENHARIA DE RECURSOS HÍDRICOS E AMBIENTAL

Saneamento, Qualidade de água

- Preenchimento de falhas em séries temporais
- Detecção de anomalias em dados
- Predição da qualidade de água (Haghiabi, Nasrolahi, Parsaie, 2018)
- Classificação e Índice de qualidade de água (Wang, Zhang, Ding, 2017)
- Qualidade de água em reservatórios (Chou, Ho, Hoang, 2018)
- Monitoramento da qualidade de água (Exemplo Universidade de Waterloo, 2018)



Schematic of overall process of image acquisition and analysis. (Credit: Jin et al., https://www.nature.com/articles/s41598-018-27406-0/figures/1.)

University of Waterloo, 2018

Automating a painstaking process

"We thought this might be interesting to investigate because when people are doing this type of water analysis, they need to do it manually," explains Dr. Wong. "Not that many people even have the expertise to do it, and even if they do, the need to do it manually means looking at the samples and counting every single microorganism inside them, which is a really painstaking process. So we thought, 'Well, we think this is something that can be automated,' mainly because of our backgrounds in AI. So our thought was, given our expertise in artificial intelligence, maybe we can leverage the machine to help us with this task so we can do it much faster and much more frequently."

The result was an AI system that uses a microscope and software to analyze water samples, searching for algae cells, and categorizing and counting any cells it finds.

"The user has to take a sample and put it under the microscope, and the AI will then actually observe what the microscope captures," details Dr. Wong. "Then it will be able to tell the user what type of cells it is seeing in the sample as well as the number of that type of cell, which is really quite critical, because these criteria are used to judge, for example, whether the water is safe, whether treatment

CUAHSI'S 2019 SPRING CYBERSEMINAR SERIES: RECENT ADVANCES IN BIG DATA MACHINE LEARNING IN HYDROLOGY

-March 29, 2019: Machine Learning & Information Theory for Land Model Benchmarking & Process Diagnostics | Grey Nearing, University of Alabama
-April 5, 2019: Long Short-Term Memory (LSTM) networks for rainfall-runoff modeling | Frederik Kratzert, Johannes Kepler University
-April 12, 2019: Use deep convolutional neural nets to learn patterns of mismatch between a land surface model and GRACE satellite | Alex Sun, University of Texas at Austin
-April 19, 2019: Long-term projections of soil moisture using deep learning and SMAP data with aleatoric and epistemic uncertainty estimates | Chaopeng Shen, Pennsylvania State University
-April 26, 2019: Exploring deep neural networks to retrieve rain and snow in high latitudes using multi-sensor and reanalysis data | Guoqiang Tang, Tsinghua University
-May 3, 2019: TBD | TBD
-May 10, 2019: Remote sensing precipitation using artificial neural networks and machine learning methods | Kuolin Hsu, University of California, Irvine

ASSIGNMENT

- Reading (09/04/2019)

https://medium.com/@ageitgey/machine-learning-is-fun-80ea3ec3c471