

Challenges and Successes in Teaching Online Using MATLAB



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Outline

Background

MATLAB and Flow

Leveraging the best of MATLAB online

Concluding remarks



Background



My work: **Visual AI**

- image processing
- medical image analysis
- computer vision
- human vision
- artificial intelligence
- machine learning
- deep learning

MATLAB user for 25 years (and counting...)

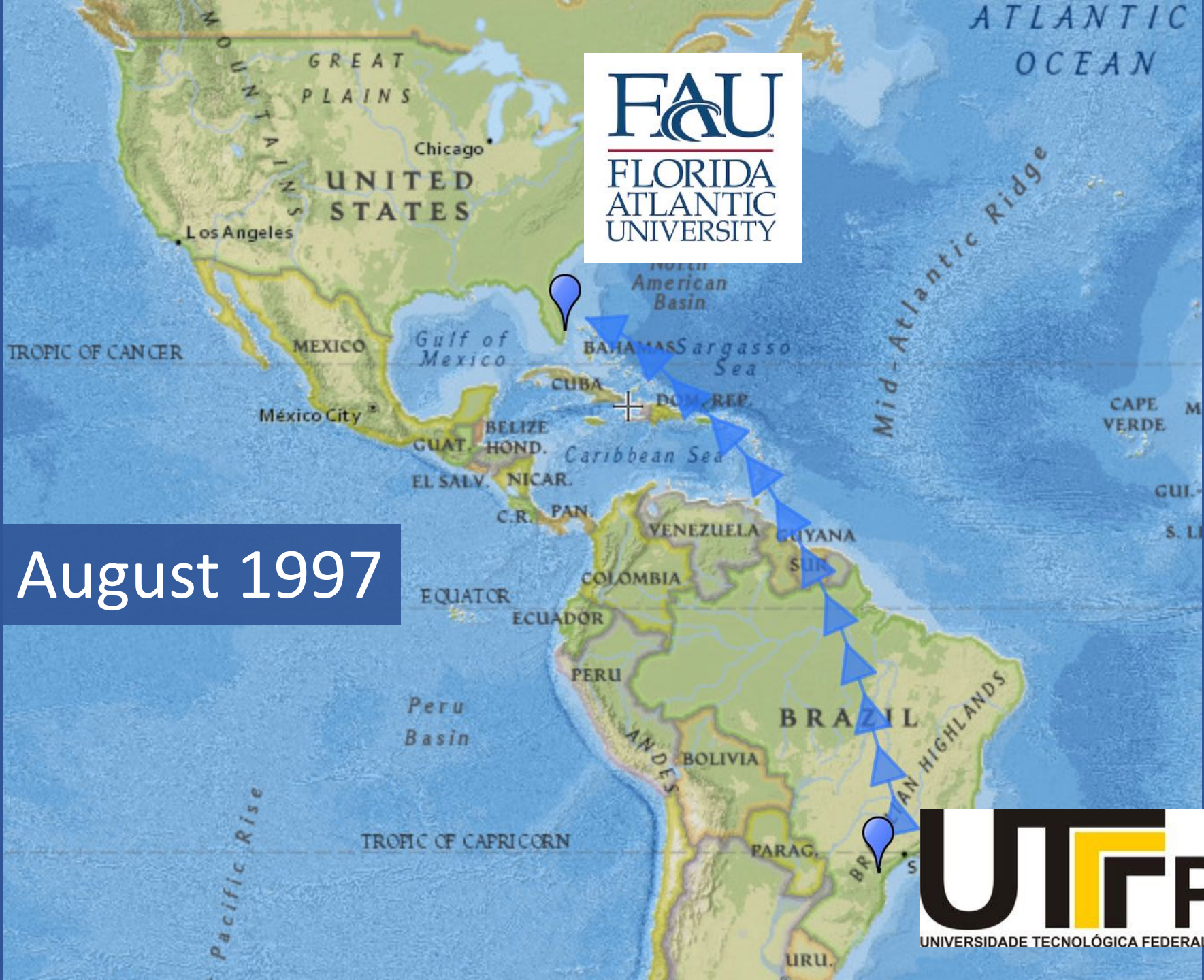
- January-February 1996
 - MATLAB + Image Processing Toolbox
- Monograph + short course (in Spanish): “Morphological Image Processing Using MATLAB”



First book (1999)

- First *Digital Image Processing* textbook in (Brazilian) Portuguese
 - 300+ pages
 - 7 hands-on MATLAB tutorials





August 1997

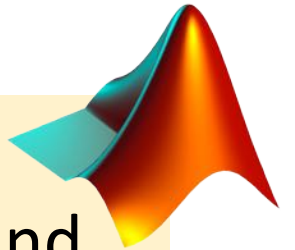


At Florida Atlantic University (2001-now)

- 2002: Created “**Digital Image Processing**” course (grad and undergrad) – taught 15 times since then
- 2005: Created “**Foundations of Vision**” course (grad) – taught 6 times since then
- 2006: Redesigned “**Video Processing**” course (grad) – taught 5 times since then
- 2008: Created “**Visual Information Retrieval**” course (grad) – taught twice since then
- 2013: Created “**Machine Learning for Computer Vision**” course (grad) – taught twice since then
- 2016: Started teaching “**Introduction to Artificial Intelligence**” (undergrad) – taught 3 times since then

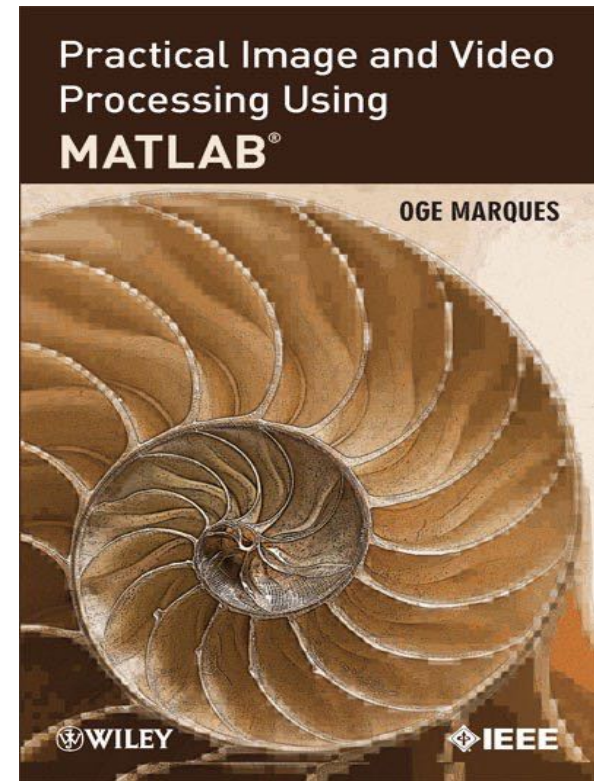
Q: What all these courses had in common?

A: Projects, assignments, and course materials using MATLAB and several Toolboxes



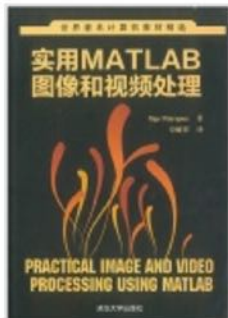
Textbook (2011)

- John Wiley & Sons + IEEE Press
- MATLAB-oriented approach: just enough math, lots of hands-on
- 30+ tutorials
- Officially adopted by 15+ universities in 12+ countries
- “Unofficially” adopted and used by a much larger “fan base”
- Five years after its publication, the book still appeared among the top 3 most downloaded eBooks from IEEE-Wiley Press in 2016



Textbook in Chinese (2013)

- Tsinghua University Press / John Wiley & Sons
World-renowned Computer Textbooks series



实用MATLAB图像和视频处理

本书对图像处理和视频处理的原理和技术进行了简洁的介绍，并结合 MATLAB 编程进行了实现。本书主要内容包括图像处理基础、MATLAB 基础、图像处理工具箱一览、图像传感和采集、算术和逻辑运算、几何操作、灰度变换、直方图处理、邻域处理、频域滤波、图像恢复、形态图像处理、边缘检测、图像分割、彩色图像处理、图像压缩和编码、特征提取和表达、视觉模式识别、视频基础、视频采样率和标准转换、数字视频处理技术和应用。各章后总共有 30 多个教程逐步引导读者利用 MATLAB 及其图像处理工具箱实现所介绍的图像和视频处理技术。

本书可作为信号与信息处理、通信与信息系统、电子与通信工程、模式识别与智能系统、计算机科学以及视觉生理学、视觉心理学和视觉认知学等学科大学高年级本科生或研究生专业课教材和教学参考书，还可供涉及图像和机器视觉技术的应用行业（如生物医学、电视广播、工业自动化、文档识别、机器人、电子医疗设备、遥感测绘、智能交通和军事侦察等）的科技工作者和从业者参考和自学。

关于本书

Oge Marques, *Florida Atlantic University*

清华大学出版社, 2013

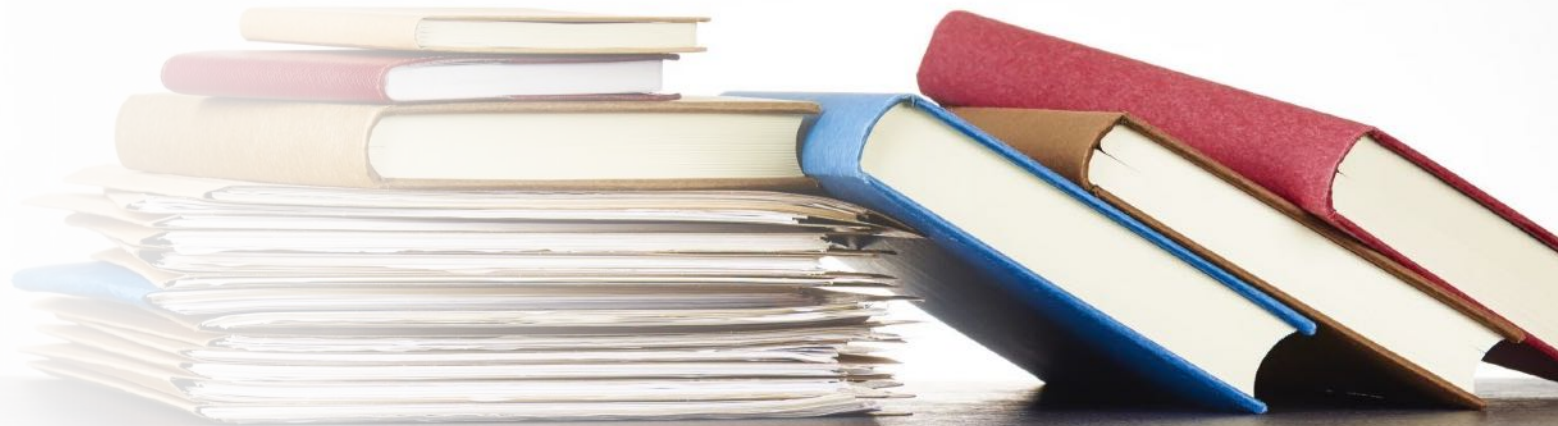
ISBN: 978-7-302-33916-8

语言: Chinese

[立即在Amazon.com上购买](#)

Ongoing Book Projects

- Image Processing Recipes Using MATLAB
- Textbook: 2nd (revised and expanded) edition



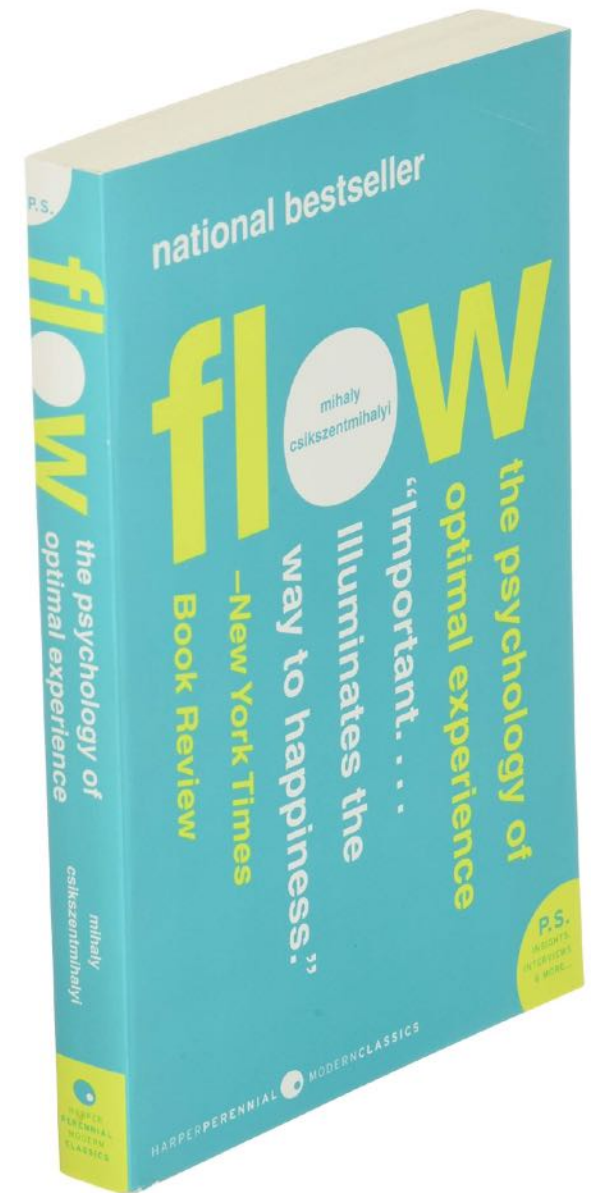


MATLAB and Flow

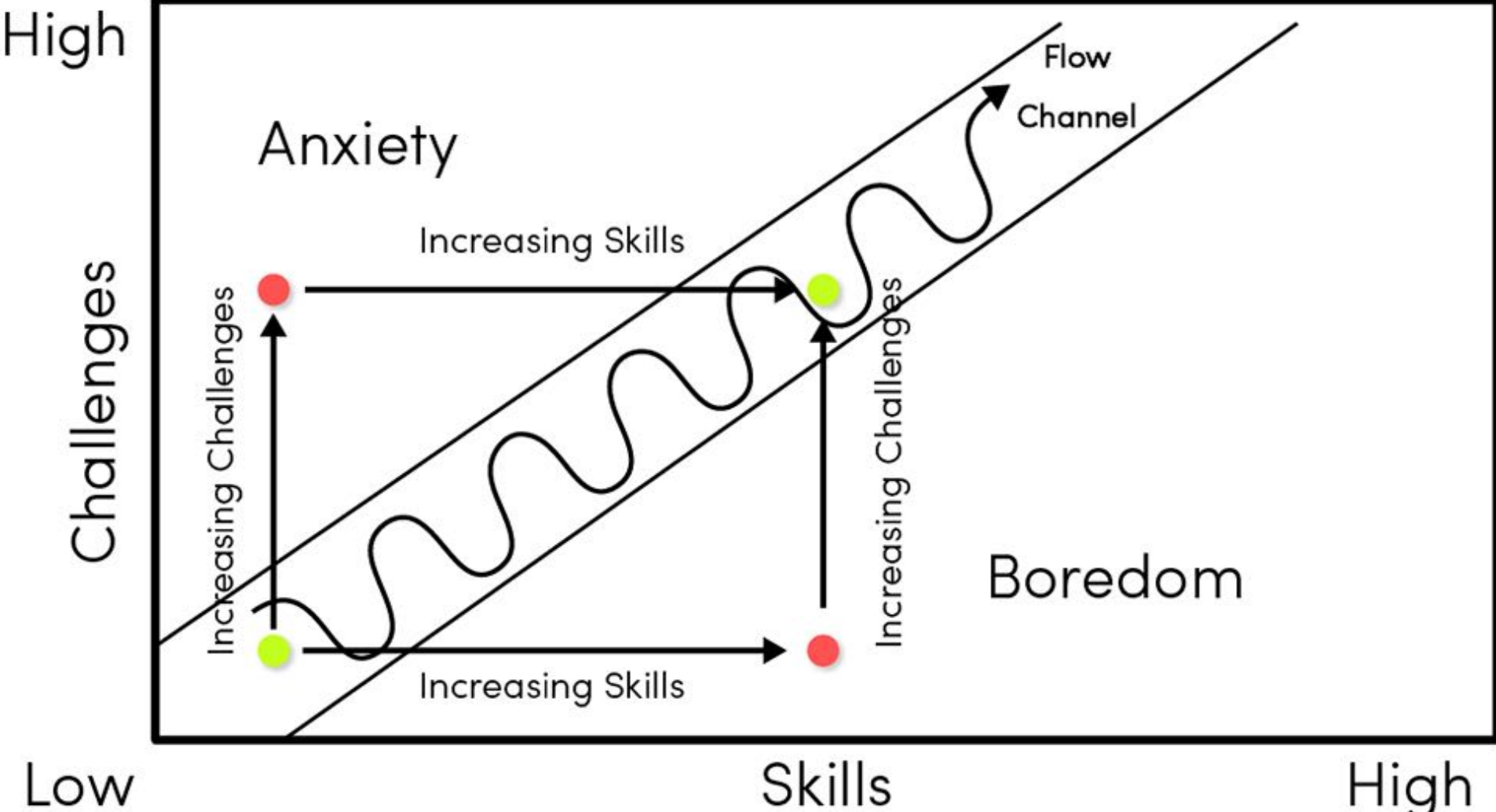


Flow

“[...] the mental state of operation in which the person is fully immersed in what he or she is doing by a feeling of energized focus, full involvement, and success in the process of the activity”



Flow and Education



Tutorials: key principles

Clear goals.

- The main goal and specific objectives are clearly stated, right at the outset.

Step-by-step procedure.

- Students should know where they're going and should follow a meaningful path to get there.

Challenging questions along the way.

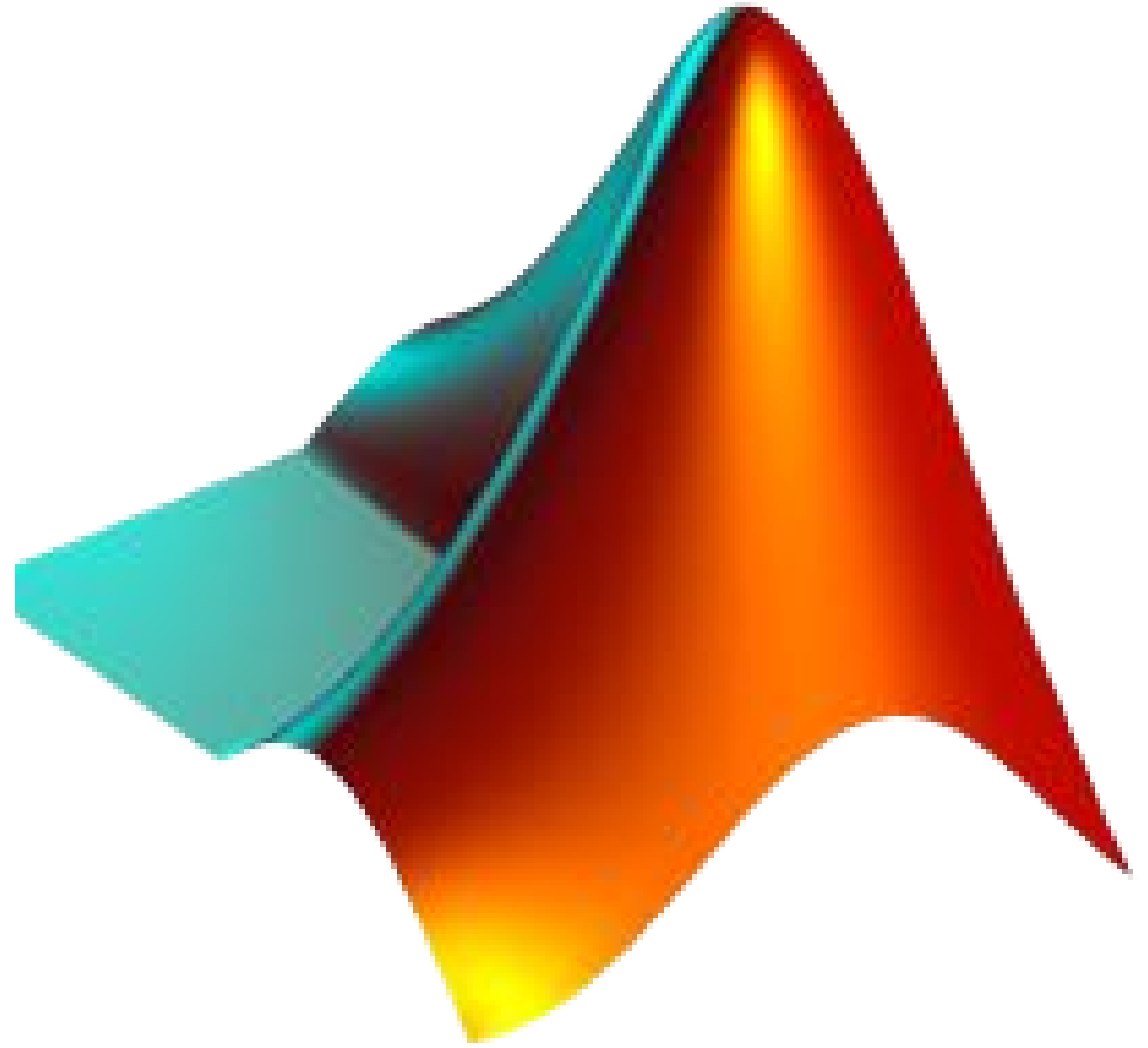
- The tutorial is interleaved with questions that challenge students to go beyond a (potentially mind-numbing) routine of just following the steps and ask them to perform more elaborate and insightful tasks.

Interactive, almost conversational, style.


- The language used in the tutorials is not excessively formal and resembles a conversation between the instructor and the student.



Leveraging the best of MATLAB online



Strategies for success in an online-first world

- Thanks to the campus-wide license agreement between my university and MathWorks, students can download MATLAB and any of its toolboxes to their personal computers as well as to use MATLAB Online, MATLAB Drive, and take online interactive courses.
 - **MATLAB Online** allows students the convenience to work directly on a web browser and save their work on their **MATLAB Drive**.
 - This has the added benefit of reducing the burden on students who might not have the financial conditions to own (and have exclusive access to) a computer with enough computational power and storage space to install and run MATLAB.
 - I encourage use of these online resources and integrate some of the online learning offerings (particularly the **Onramps**) into my courses.
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Beyond
textbooks
(and their
tutorials)

Guided Tours

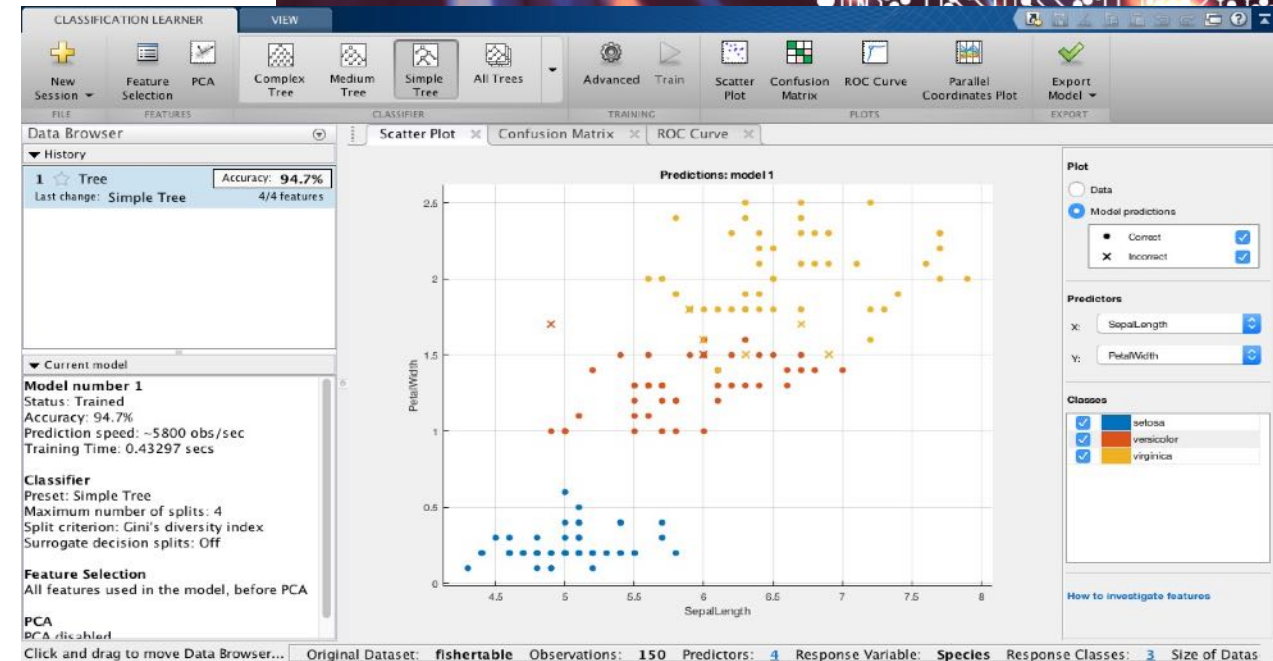
Code contributions

Blogs

A Guided Tour to Machine Learning Using MATLAB

- **Highlights**

- MATLAB Onramp (*required*)
- "Introducing Machine Learning" e-book
- Classification Learner App
 - Classification
 - Regression
 - PCA
 - Much more
- Videos, documentation, blog posts, MATLAB Central, etc.



Code contributions (GitHub + File Exchange)

<https://github.com/ogemarques>

 MATLAB® File Exchange

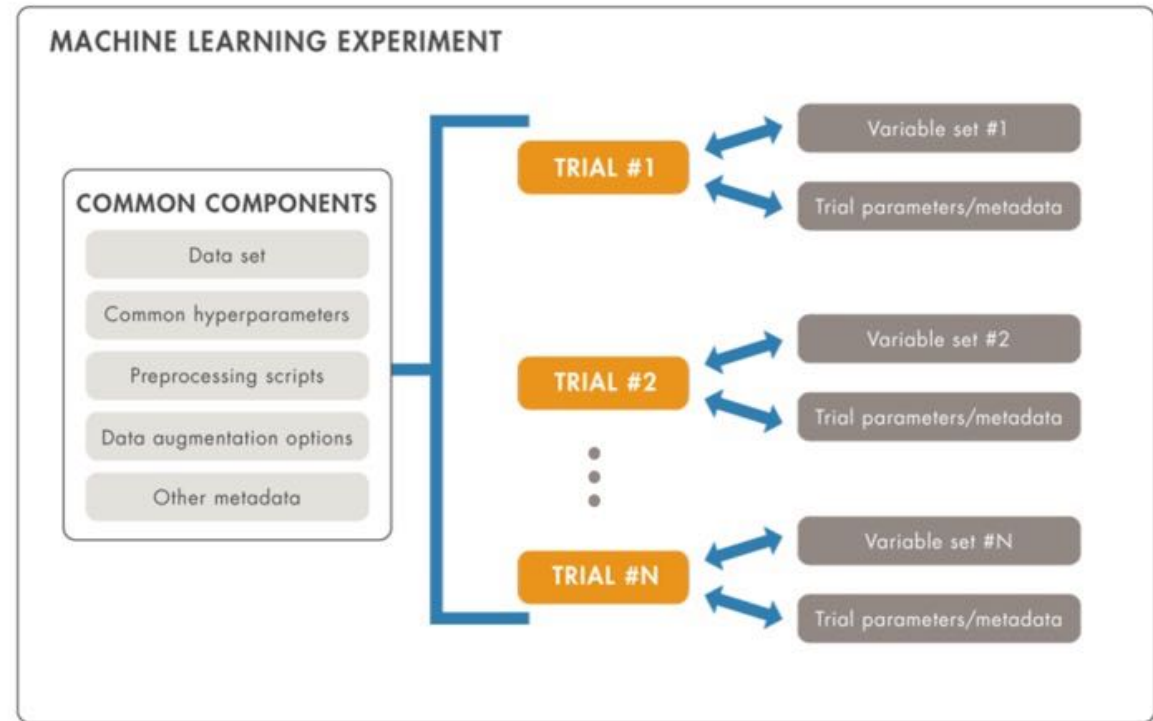
Managing medical image classification experiments with MATLAB Experiment Manager App

This repository shows an example of how to use MATLAB Experiment Manager for a medical image classification task.

Experiment objective

To test the best combination of pretrained deep learning model and optimizer for a binary (*malignant* or *benign*) skin lesion classification task using transfer learning.

Blogs



Tracking Experiments to Improve AI Accuracy

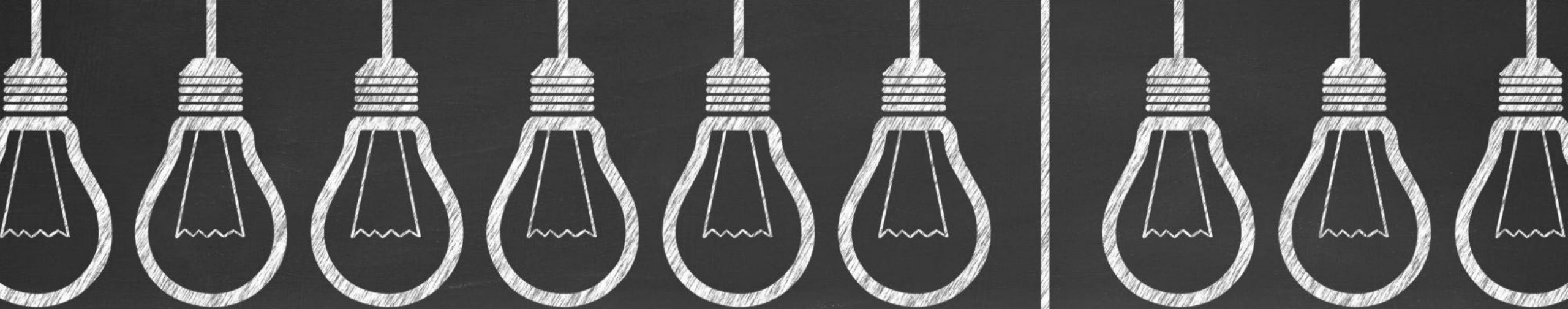
Posted by OGE MARQUES on July 1, 2021 at 6:00am [View Blog](#)

The development of machine learning and deep learning solutions typically follows a [workflow](#) that starts from the problem definition and goes through the crucial steps of collecting and exploring useful data, training and evaluating candidate models, deploying a solution, and finally documenting and maintaining the system once it is running in the wild (Figure 1). Despite its predictable structure, some steps of this process are iterative by nature and usually require multiple rounds of adjustments, fine-tuning, and optimizations.

<https://www.datasciencecentral.com/profile/OGEMARQUES>

Concluding Remarks





Nurturing
independent lifelong
learners



