

# Sabbatical Report

## Fall 2022/Spring 2023

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### I. Introduction

The opportunity to take an extended period to reflect and grow is special benefit from working in academia. My sabbatical has been a unique experience that has combined many years of experience, with a returning home. The opportunity has opened as many new questions as ideas, but has certainly been a period appreciated.

### II. Context

After 10 years or experience at Fresno State as a lecturer in Computer Science my sabbatical was combined with a move back to the home where I grew up, and attended Fresno State as a student, to care for my mother with late stage Alzheimer's. Being back home in the old neighborhood should have helped understand STEM outreach be so close to the community I branched out from, but probably raised more questions than answers.

#### A. STEM Outreach

Students are interested in sharing their about themselves and meeting others. Although wary of jumping into new communities, do enjoy reaching out. My goal in teaching is to look to provide opportunities for students to share a bit about themselves within the context of class. My main mechanism is going to be online discussions, connecting to in-class discussions. Presentations will provide another mode for class interaction with more advanced classes.

This ability for classes to provide mechanisms for students to explore interactions with each other, is an important part of the academic experience. It will also help promote the idea of interleaving personal components of life with work life, and important step towards understanding how to manage work/life balancing.

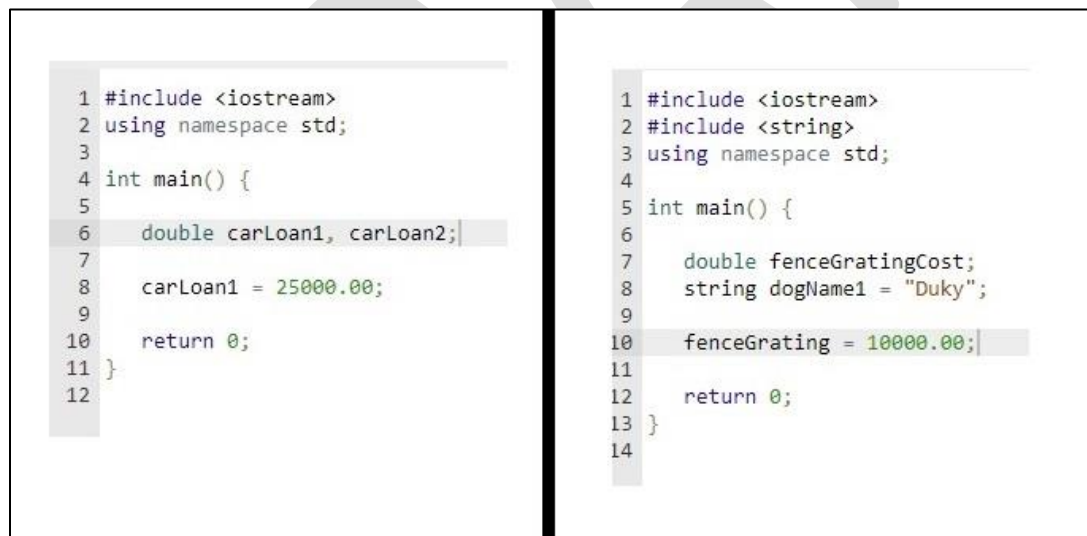
## B. Abstract Thinking

In looking to connect STEM to old neighborhood, I considered where symbols were being utilized. Neighbors expended much energy and thought into their home presentation, utilizing a variety of abstractions. Students will have same desire with classroom engagement.



*Figure 1 Neighborhood Symbols: Cars, Fences, Plants, etc.*

Figure 2 Code Subtext illustrates two code snippets that contain personalized elements. The left one indicates two car loans, while the right one shows a grate fence and a dog named “Duky”. These types of shared elements not only allow students to connect with each other, but help them understand that code is read by humans and includes subtext.

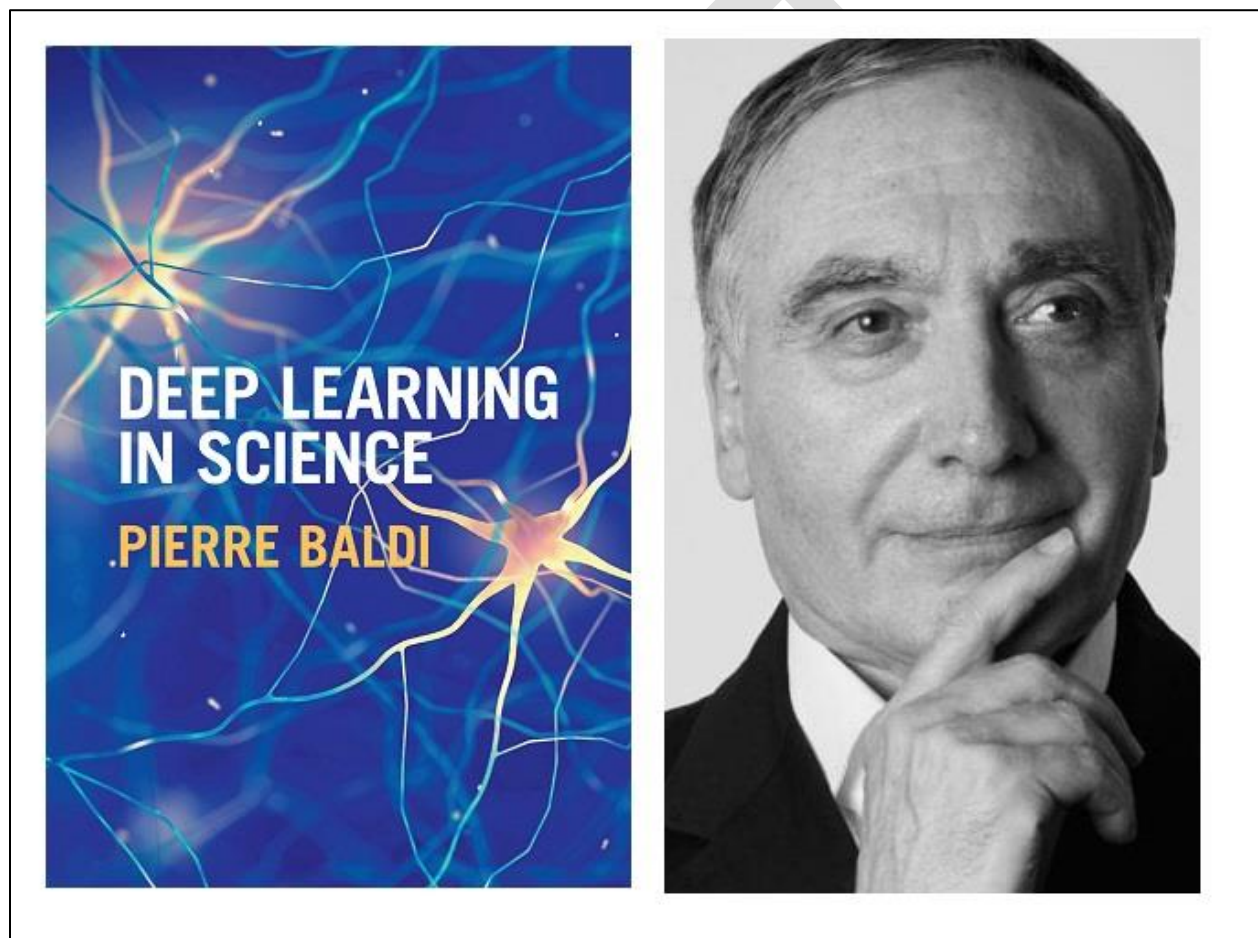


*Figure 2 Code Subtext*

## III. Data and Artificial Intelligence

My research work quickly moved towards Deep Learning. As a breakthrough area generating headline grabbing results, it is clear that this is an area where our departments can help students understand the technology.

Until the late 2000's deep neural nets were not able to shine against other machine learning methods. This changed in the late 2009-2010 with several simple but important algorithmic improvements: activation functions, weight initialization schemes, optimization schemes. With these improvements nets of 10 or more layers, allowing deep learning to start to shine. In 2014, 2015, 2016, further improvements introduced with batch normalization, residual networks, and depthwise separable convolutions. Now arbitrarily complex networks are possible. [3]



*Figure 3 Deep Learning & Neuroscience [4]*

Although many researchers approach Deep Learning purely from an algorithmic perspective, some researchers do emphasize the connection to biological neurological systems. Dr. Pierre Baldi with his Deep Learning text encourages researchers to understand these ties. [4]

### C. Neurons and Deep Learning

Deep learning has its root in traditional machine learning, which in turn has multiple roots. One root definitely includes the work from neurobiology in understanding brain functioning, and the basic unit the neuron. The perceptron, and its perceptron learning algorithm has always been an important part of machine learning history. [5] Later Yann LeCun took inspiration from animal visual cortex architecture such as the early work of Hubel & Wiesel with cats to with his work with hand-written character recognition. [6] [7]

## IV. References

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