

## CERTIFICATE

**Giulio Campagna**

has completed the 2.0 ECTS PhD course

**"Deep Learning"**

6 ,9 and 11 May, 2022

**Description:** Deep learning is an emerged area of research in machine learning and has recently shown huge success in a variety of areas. The impact on many applications is revolutionary, which ignites intensive studies of this topic. During the past few decades, the prevalent machine learning methods, including support vector machines, conditional random fields, hidden Markov models, and one-hidden-layer multi-layer perceptron, have found a broad range of applications. While being effective in solving simple or well-constrained problems, these methods have one drawback in common, namely they all have shallow architectures. They in general have no more than one or two layers of nonlinear feature transformations, which limits their performance on many real-world applications. On the contrary, the human brain and its cognitive process, being far more complicated, have deep architectures that are organized into many hierarchical layers. The information gets more abstract while going up along the hierarchy. Interests in using deep architectures have been reignited by many amazing applications enabled by deep learning techniques. During the past years, deep learning methods and applications have witnessed unprecedented success.

This course gave an introduction to deep learning both by presenting valuable methods and by addressing specific applications. This course covered both theory and practices for deep learning. The students also had hands-on exercises experimenting a variety of deep learning architectures for applications.

Topics included:

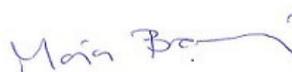
- Machine learning fundamentals
- Deep learning concepts
- Deep learning methods including deep autoencoders, deep neural networks, recurrent neural networks, long short-term memory recurrent networks, convolutional neural networks, and generative adversarial networks.
- Selected applications of deep learning

**Course responsible:** Professor Zheng-Hua Tan

**Course lecturers:** Professor Zheng-Hua Tan, Dr. Ivan Lopez-Espejo, and Dr. Sven Ewan Shepstone (Bang & Olufsen).



**Mads Græsbøll Christensen**  
PhD Study Director



**Maria Bredvig**  
AAU PhD