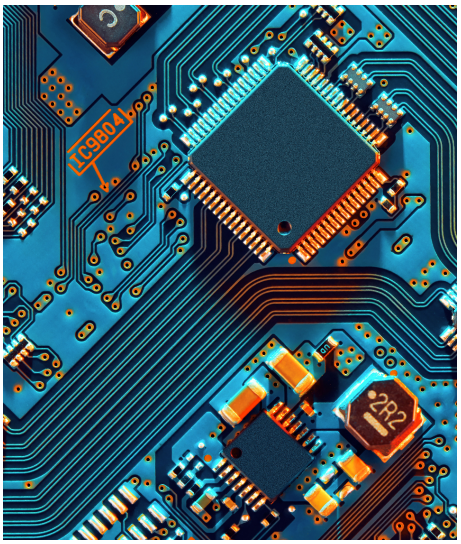
UNIVERSIDAD DE GRANADA

Departamento de Teoría de la Señal, Telemática y Comunicaciones

Charla: Mad Max, Affine Spline Insights into Deep Learning

02/05/2020

Charla



Celebrada en el contexto de la asignatura Tecnologías del Habla el Miércoles 27 de noviembre a las 8:30 de la mañana en el Aula 1.6, tiene lugar la charla “Mad Max: Affine Spline Insights into Deep Learning”, impartida por Richard Baraniuk, Professor at Rice University and the Founding Director of OpenStax.

We build a rigorous bridge between deep networks (DNs) and approximation theory via spline functions and operators. Our key result is that a large class of DNs can be written as a composition of max-affine spline operators (MASOs), which provide a powerful portal through which to view and analyze their inner workings. For instance, conditioned on the input signal, the output of a MASO DN can be written as a simple affine transformation of the input. This implies that a DN constructs a set of signal-dependent, class-specific templates against which the signal is compared via a simple inner product; we explore the links to the classical theory of optimal classification via matched filters and the effects of data memorization. Going further, we propose a simple penalty term that can be added to the cost function of any DN learning algorithm to force the templates to be orthogonal with each other; this leads to significantly improved classification performance and reduced overfitting with no change to the DN architecture. The spline partition of the input signal space that is implicitly induced by a MASO directly links DNs to the theory of vector quantization (VQ) and K-means clustering, which opens up new geometric avenue to study how DNs organize signals in a hierarchical fashion. To validate the utility of the VQ interpretation, we develop and validate a new distance metric for signals and images

that quantifies the difference between their VQ encodings.

BIO Richard G. Baraniuk is the Victor E. Cameron Professor of Electrical and Computer Engineering at Rice University and the Founding Director of OpenStax. His research interests lie in new theory, algorithms, and hardware for sensing, signal processing, and machine learning. He is a Fellow of the American Academy of Arts and Sciences, National Academy of Inventors, American Association for the Advancement of Science, and IEEE. He has received the DOD Vannevar Bush Faculty Fellow Award (National Security Science and Engineering Faculty Fellow), the IEEE Signal Processing Society Technical Achievement Award, and the IEEE James H. Mulligan, Jr. Education Medal, among others.