

Generalization Error Bounds

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There are many approaches to the notion of ‘generalization’ in theories of machine learning. In this tutorial, we look at several mathematical approaches. We start by describing one popular mathematical approach to generalization in the context of concept learning. We emphasize how this model of generalization relates to results in probability theory. We then examine how one might extend this notion of generalization to other models of learning, especially those in which real-valued functions are used. Here, we discuss the theoretical work that helps to justify the paradigm of learning with a large ‘margin’, something that is a key feature of support vector machines.

I aim to give a flavour of the types of result that can be obtained in studying generalization using techniques from probability theory and discrete mathematics.

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Martin Anthony is currently Professor of Mathematics and Head of Department in the Mathematics Department at the London School of Economics and Political Science. He is also a member of LSE's Centre for Discrete and Applicable Mathematics. He has worked on the mathematical modeling of learning and generalization and is the author or co-author of four books, including 'Discrete Mathematics of Neural Networks: Selected Topics' and (with Peter Bartlett) 'Neural Network Learning: Theoretical Foundations'.