PhD position
"Free Probability Aspects of Neural Networks"

The research group on Free Probability at Saarland University, Saarbrücken, Germany is offering a 3-year PhD position. The position is funded by the Deutsche Forschungsgemeinschaft DFG. It is payed as a 75% position by German standards (E13 TV-L). There are no teaching duties. German language skills are welcome but not obligatory.

Project Description: Neural networks are, roughly speaking, functions of many parameters in a high-dimensional space and the training of such a network consists in finding the parameters such that the function does what it is supposed to do on the "training inputs", but also generalizing this in a meaningful way to "real test inputs".
Random matrix and free probability theory are mathematical theories which deal with typical behaviours of functions (which have an underlying matrix structure) in high dimensions and in the limit of large matrix size. Thus it is not surprising that those theories should have something to offer for describing and dealing with neural networks. Accordingly, there have been approaches relying on random matrix and/or free probability theory to investigate questions around deep learning.
This interaction between free probability and neural networks is hoped to be bi-directional in the long run. However, the project will not address practical purposes of deep learning; instead we want to take the deep learning challenges as new questions around random matrices and free probability and we aim to develop those theories further on a mathematical level.

Prerequisites: Applicants should have an equivalent of a Master's degree and a background in at least one of the subjects

- free probability
- random matrices
- neural networks

and an interest in learning the remaining ones and, in particular, in working on their interrelations.

Application: Inquiries and applications should be addressed to Roland Speicher. Your application, in German or in English, should arrive before **June 20, 2021**. It should contain your curriculum vitae and an abstract of your Master's thesis. Arrange also for at least one recommendation letter to be sent directly to Roland Speicher, preferably by email. State in your application the name of those you asked for such a letter .

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