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in shallow ESN, in line with [6]. In this case, however, the possible final performance enhancement is less pronounced than the one seen for deep reservoirs.

5 Conclusions

We have investigated the effects of architectural simplifications in the design of deep RC models. Remarkably, a very simple DeepESN with ring topology in each reservoir layer and deterministically constructed input and inter-layer connections showed the highest performance in comparison to more complex (both shallow and deep) RC setups. Overall, our analysis put forward a minimalistic deep RNN architecture, with few degrees of freedom and no randomization in its construction, as a very effective tool for learning tasks in the time-series domain.

Looking ahead, we believe that the advantages of minimal deep RC architectures can be exploited massively in real-world applications, e.g., in the context of Machine Learning embedded on edge devices. Moreover, the analysis conducted in this paper can be capitalized to extend the advantages of minimal deep RC architectures to the case of learning in graph domains [10].

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