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<tr><th rowspan="2">cases</th><th>doc_1</th><th>doc_2</th><th>decision</th><th>id</th></tr>
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authors	• Baccelli, FranÃ§ois • Taillefumier, Thibaud
title	The Pair-Replica-Mean-Field Limit for Intensity-based Neural Networks
publication_date	2020-04-13 00:00:00
source	SupportedSources.CORE
journal	
volume	
doi	10.1137/20m1331664
urls	• http://arxiv.org/abs/2004.06246
id	id-3944217949660509231
abstract	Replica-mean-field models have been proposed to decipher the activity of neural networks via a multiply-and-conquer approach. In this approach, one considers limit networks made of infinitely many replicas with the same basic neural structure as that of the network of interest, but exchanging spikes in a randomized manner. The key point is that these replica-mean-field networks are tractable versions that retain important features of the finite structure of interest. To date, the replica framework has been discussed for first-order models, whereby elementary replica constituents are single neurons with independent Poisson inputs. Here, we extend this replica framework to allow elementary replica constituents to be composite objects, namely, pairs of neurons. As they include pairwise interactions, these pair-replica models exhibit non-trivial dependencies in their stationary dynamics, which cannot be captured by first-order replica models. Our contributions are two-fold: (i) We analytically characterize the stationary dynamics of a pair of intensity-based neurons with independent Poisson input. This analysis involves the reduction of a boundary-value problem related to a two-dimensional transport equation to a system of Fredholm integral equations---a result of independent interest. (ii) We analyze the set of consistency equations determining the full network dynamics of certain replica limits. These limits are those for which replica constituents, be they single neurons or pairs of neurons, form a partition of the network of interest. Both analyses are numerically validated by computing input/output transfer functions for neuronal pairs and by computing the correlation structure of certain pair-dominated network dynamics.Comment: 40 pages, 6 figure
versions	

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authors	• FranÃ§ois Baccelli • Thibaud Taillefumier
title	The Pair-Replica-Mean-Field Limit for Intensity-based Neural Networks
publication_date	2020-04-14 00:00:00
source	SupportedSources.INTERNET_ARCHIVE
journal	
volume	
doi	
urls	• https://web.archive.org/web/20200416020828/https://arxiv.org/pdf/2004.06246v1.pdf
id	id5178389336278090729
abstract	Replica-mean-field models have been proposed to decipher the activity of neural networks via a multiply-and-conquer approach. In this approach, one considers limit networks made of infinitely many replicas with the same basic neural structure as that of the network of interest, but exchanging spikes in a randomized manner. The key point is that these replica-mean-field networks are tractable versions that retain important features of the finite structure of interest. To date, the replica framework has been discussed for first-order models, whereby elementary replica constituents are single neurons with independent Poisson inputs. Here, we extend this replica framework to allow elementary replica constituents to be composite objects, namely, pairs of neurons. As they include pairwise interactions, these pair-replica models exhibit non-trivial dependencies in their stationary dynamics, which cannot be captured by first-order replica models. Our contributions are two-fold: (i) We analytically characterize the stationary dynamics of a pair of intensity-based neurons with independent Poisson input. This analysis involves the reduction of a boundary-value problem related to a two-dimensional transport equation to a system of Fredholm integral equationsâ€"a result of independent interest. (ii) We analyze the set of consistency equations determining the full network dynamics of certain replica limits. These limits are those for which replica constituents, be they single neurons or pairs of neurons, form a partition of the network of interest. Both analyses are numerically validated by computing input/output transfer functions for neuronal pairs and by computing the correlation structure of certain pair-dominated network dynamics.
versions	

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