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Parameter identifiability of linear-compartmental mammillary models: methods and sensitivity checks

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Linear compartmental models are a widely used tool for analyzing systems arising in biology, medicine, and more. In such settings, it is essential to know whether model parameters can be recovered from experimental data. This is the identifiability problem. For a class of linear compartmental models with one input and one output, namely, those for which the underlying graph is a bidirected tree, Bortner et al. completely characterized which such models are structurally identifiability, which means that every parameter is generically locally identifiable. Here, we delve deeper, by examining which individual parameters are locally versus globally identifiable. Specifically, we analyze mammillary models, which consist of one central compartment which is connected to all other (peripheral) compartments. For these models, which fall into five infinite families, we determine which individual parameters are locally versus globally identifiable, and we give formulas for some of the globally identifiable parameters in terms of the coefficients of input-output equations. Our proofs rely on a combinatorial formula due to Bortner et al. for these coefficients.

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