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Transferring the Knowledge between Different Populations and Species by Using a Functional Deep Neural Network

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Artificial intelligence (AI) is a thriving research field with many successful applications in areas such as computer vision and speech recognition. Neural-network-based methods, such as deep learning, play a central role in modern AI technology. While neural networks hold great promise for modeling the complex relationship between genotypes and phenotypes, the applications of these methods in genetic research are still limited. In this project, we incorporate the idea of transfer learning into a functional deep neural network for transferring the knowledge between different populations and species. We illustrate the use of the proposed method in two applications. In the first application, we learn the relationship between candidate genes and nicotine dependence from the Caucasian population, and use that to improve our analysis in other minority populations (e.g., African American). In the second application, we use the rat data to build the model and explore its use in genetic research of mouse.