

# An Evolutionary Algorithm Approach to Link Prediction in Dynamic Social Networks

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## Abstract

Many real world, complex phenomena have an underlying structure of evolving networks where nodes and links are added and removed over time. A central scientific challenge is the description and explanation of network dynamics, with a key test being the prediction of short and long term changes. For the problem of short-term link prediction, existing methods attempt to determine neighborhood metrics that correlate with the appearance of a link in the next observation period. Here, we provide a novel approach to predicting future links by applying an evolutionary algorithm (Covariance Matrix Evolution) to weights which are used in a linear combination of sixteen neighborhood and node similarity indices. We examine reciprocal reply networks of Twitter users constructed at the time scale of weeks, both as a test of our general method and as a problem of scientific interest in itself. Our evolved predictors exhibit a thousand-fold improvement over random link prediction, to our knowledge strongly outperforming all extant methods. Based on our findings, we suggest possible factors which may be driving the evolution of Twitter reciprocal reply networks.

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