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# Forecasting Judgment: The Netflix Prize and Collaborative Filtering

By Mike Lindstrom

One way to predict the numerical outcome of an event is to ask a panel of experts, and then take the average of their answers. Delphi studies, statistical surveys and other judgmental forecasting techniques are commonly used when attempting to glean the general from a variety of individual opinions. Some forecasters however, move in the opposite direction. Can the aggregate results from a group be used to forecast something as subjective and judgmental as one single person's opinion? Forecasting of this type commonly uses a set of techniques known as collaborative filtering, and one company has paid \$1,000,000 to do it better.<sup>1</sup>

## THE NETFLIX PRIZE CHALLENGE

Beginning in 2006, Netflix sponsored a contest to “predict whether someone will enjoy a movie based on how much they liked or disliked other movies.”<sup>2</sup> At that time, the company currently had a predictive model, in order to recommend movies to individual customers. The goal of the contest was to improve on their current model by 10 percent.

More specifically, the challenge was to design a model that can predict the rating a particular user would give to a movie. Netflix users are allowed to give movies a rating of one to five stars. Teams of contestants designed models that predicted the ratings for particular users and movie titles. These modeled ratings were then compared to the actual ratings the user had given to those movies. How well a model performed was gauged by comparing the root mean squared error of model results with the root mean squared error of the Netflix model on the same data set.

In addition to the grand prize, Netflix also offered an annual \$50,000 progress prize, which was awarded in 2007 and 2008 to the leading team. By October of 2009, the contest had been won when a team beat the current prediction algorithm by 10.06 percent.<sup>3</sup>

## USING A MODEL TO JUDGE: COLLABORATIVE FILTERING

How can a model predict which movies I will like? I really enjoyed the movie “*Fargo*,” as well as “*The Big Lebowski*,” two movies directed by the Coen Brothers. When they released another movie called “*No Country for*

*Old Men*,” I was pretty sure that I would like that movie as well. This is called the nearest-neighbor approach and is a type of forecasting called collaborative filtering. In the nearest-neighbor approach, a piece of the predicted rating is a weighted average of similar, or neighboring items, where the weights are the item similarities.<sup>4</sup>

A more abstract type of collaborative filtering is called the latent-factor approach. This approach is used to discover patterns in the data set that may not be apparent or easily explainable. The predicted review is then based on a set of factors that correspond to the particular movie and user.<sup>5</sup>

## DIFFICULTIES IN MODELING JUDGMENT

Obviously at this point human judgment and opinion cannot be completely captured in a mathematical model. For example, an average answer might be way off if opinions are at the extremes. Consider a problem discovered early on in the Netflix contest called the “*Napoleon Dynamite*” effect,<sup>6</sup> which arises from the movie of the same name. This is an example of a movie that people tend to either love or hate, so actual ratings are either a “1” or a “5.” Any model that relies on an average prediction for that type of movie will show a relatively large error each time.

There are other undeniably human attributes that lead to inaccurate predictions, some of which can be modeled.<sup>7</sup> Our opinions are significantly influenced by things that are within close proximity, a bias in judgment called anchoring. For example, I might watch several really bad movies and then give a good movie a lower rating than it deserves. Also, temporal effects are evident in ratings. Types of movies can go in and out of style. Other factors can affect reviews like the day of the week a movie was watched, or the number of movies that had been watched recently.

Also, no two people use the same absolute scale so a model could take into account the fact that some people are harsher critics than others. Some users may reserve five stars for only their absolute favorite movies while other people may concentrate ratings on the high end of the scale.

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## OTHER FORECASTING COMPETITIONS

Besides the Netflix Prize, other organizations have sponsored their own forecasting competitions and challenges. Most notably these include the M Competition and the time-series prediction competition sponsored by the Santa Fe Institute.

In this edition, you can see information on a forecasting application contest sponsored by our section. The award is not as significant as the Netflix Prize, but we urge you to enter and share your thoughts and expertise. Later this year the Forecasting and Futurism Section will sponsor a larger forecasting competition for actuaries. Look for an announcement of the competition at the SOA Annual Meeting.



Mike Lindstrom

**Mike Lindstrom, ASA, MAAA**, is associate actuary at Federal Life Insurance Company (Mutual). He can be reached at [mlindstrom@federallife.com](mailto:mlindstrom@federallife.com).

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