3-2018

Why Superforecasters Change Their Estimates on Average by 3.5%: A Possible Theoretical Explanation

Olga Kosheleva
The University of Texas at El Paso, olgak@utep.edu

Vladik Kreinovich
The University of Texas at El Paso, vladik@utep.edu

Comments:

Technical Report: UTEP-CS-18-20

Why Superforecasters Change Their Estimates on Average by 3.5%: A Possible Theoretical Explanation

Olga Kosheleva[1] and Vladik Kreinovich[2]
[1]Department of Teacher Education
[2]Department of Computer Science
University of Texas at El Paso
500 W. University
El Paso, TX 79968, USA
olgak@utep.edu,vladik@utep.edu

Abstract

A recent large-scale study of people's forecasting ability has shown that there is a small group of *superforecasters*, whose forecasts are significantly more accurate than the forecasts of an average person. Since forecasting is important in many application areas, researchers have studied what exactly the supreforecasters do differently – and how we can learn from them, so that we will be able to forecast better. One empirical fact that came from this study is that, in contrast to most people, superforecasters make much smaller adjustements to their probability estimates. On average, their average probability change is 3.5%. In this paper, we provide a possible theoretical explanation for this empirical value.

1 Formulation of the Problem

Who are superforecaters. People make forecasts all the time.

- We make a forecasts when we change a job – we forecast that that the new job will last for a significant amount of time.
- We make a forecast when we buy a house – this real estate prices in this area do not drop, making us lose most of our investment, etc.

Some people are better in making forecasts, some are worse. To analyze people's ability to make predictions, Dr. Philip E. Tetlock ran a long-term experiment in which many people tried to predict events (mostly outside their usual are of expertise), e.g.:

- the outcome of an election in a faraway country, or

- future price of oil.

People were asked to provide, for each forecast, the probability to which they believe in their answer. After that, the researchers compared these probabilities with the actual frequencies of correct forecasts.

Somewhat surprisingly, it turned out that:

- while for most forecasters, such prediction are not more successful than random guesses,
- there is a small group of participants whose forecasts were consistently significantly more accurate than a random guess.

Tetlock called such people *superforecaters*; see [3] and references therein.

Superforecasters Change Their Estimates on Average by 3.5%. In many application areas, it is important to make good forecasts. It is therefore desirable to analyze how superforecaster do it, what do they do differently, so that we can all learn from them and become better forecasters.

One such difference is related to how people change their probabilities when presented with new information. When a new information appears:

- most people make a significant change in their probabilities, while
- for superforecasters, most changes are small: the average change is 3.5%.

How can we explain this empirical fact? The value 3.5% is not just an accidental average: according to [3], it appears consistently when we analyze a group of superforecasters.

This consistency is an indication that there should be a theoretical explanation for this empirical phenomenon.

What we do in this paper. In this paper, we provide a possible explanation for this phenomenon.

2 Possible Explanation

Main idea. The main idea behind our explanation is the well-known *seven plus minus two law* [1, 2], according to which people divide everything into 7 ± 2 groups: on average, into 7 groups.

How this idea applies to probabilities. In particular, when we gauge probabilities, then, instead of considering all possible values from the interval $[0, 1]$, we divide these values into, on average, 7 subintervals.

In the first approximation, it is reasonable to assume that these subintervals have equal length, i.e., that we consider intervals

$$\left[0, \frac{1}{7}\right], \quad \left[\frac{1}{7}, \frac{2}{7}\right], \quad \left[\frac{2}{7}, \frac{3}{7}\right], \quad \left[\frac{3}{7}, \frac{4}{7}\right], \quad \left[\frac{4}{7}, \frac{5}{7}\right], \quad \left[\frac{5}{7}, \frac{6}{7}\right], \quad \left[\frac{6}{7}, 1\right].$$

As a natural representation of each interval we can take its midpoint. So we end up with the following seven typical probability values:

$$\frac{1}{14},\quad \frac{3}{14},\quad \frac{5}{14},\quad \frac{7}{14}\left(=\frac{1}{2}\right),\quad \frac{9}{14},\quad \frac{11}{14},\quad \frac{13}{14}.$$

What happens when a normal forecaster changes his/her probabilities. When a normal forecaster changes the probabilities, they switch from one of these probabilities to the previous or next one, with an average change of about $\frac{1}{7} \approx 14\%$.

What happens when a superforecaster changes his/her probabilities. According to [3], superforecasters do not stay in the above first-approximation level of describing probabilities, they use, so to say, second-order detailing.

Based on the general seven plus minus two law, it is reasonable to assume that they have, on average, seven sub-levels connecting every two neighboring probability levels:

$$0 - 1 - 2 - 3 - 4 - 5 - 6 - 7.$$

Here:

- 0 is the sub-level corresponding to the first probability level, and
- 7 is the sub-level corresponding to the second probability level.

Sub-levels 0, 1, 2, and 3 are closest to the first probability level, while sub-levels 4, 5, 6, and 7 are closer to the second probability level.

So:

- if we start at the first probability level (which corresponds to sub-level 0),
- then we first move to sub-level 1 – which still corresponds to the same probability level.
- Then, we move to sub-level 2 – which still corresponds to the original probability level.
- Only when we make 4 such steps and reach sub-level 4, then we switch to the next probability level.

This explains the 3.5% phenomenon. As we have mentioned earlier, two neighboring probability levels different by $\approx 14\%$.

We have shown that to switch from one probability level to the next one, we need to preform four updating steps. Thus, on average, each updating step changes the probability by a value of $\frac{14\%}{4}$, which is exactly 3.5%.

Acknowledgments

This work was supported in part by the US National Science Foundation grant HRD-1242122.

References

[1] G. A. Miller, "The magical number seven, plus or minus two: Some limits on our capacity for processing information", *Psychological Review*, 1956, Vol. 63, No. 2, pp. 81–97.

[2] S. K. Reed, *Cognition: Theories and application*, Wadsworth Cengage Learning, Belmont, California, 2010.

[3] P. E. Tetlock and D. Gardner, *Superforecasting: The Art and Science of Prediction*, Broadway Books, New York, 2015.