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How to Deal with Conflict of Interest Situations When Selecting the Best Submission

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Abstract In many practical situations when we need to select the best submission – the best paper, the best candidate, etc. – there are so few experts that we cannot simply dismiss all the experts who have conflict of interest: we do not want them to judge their own submissions, but we would like to take into account their opinions of all other submissions. How can we take these opinions into account? In this paper, we show that a seemingly reasonable idea can actually lead to bias, and we explain how to take these opinions into account without biasing the final decision.

1 Formulation of the Problem

Need for expert opinions. In many practical situations, we rely on human expertise. This happens when we review papers, this happens when we decide on an award, this happens when we decide which of the faculty candidates to hire, etc.

Usually, each expert i provides a numerical estimate e_{ij} of the quality of each submission j: the larger this estimate, the higher the quality. Then, for each submission j, we take the sum

$$s_j \stackrel{\text{def}}{=} \sum_i e_{ij} \tag{1}$$

of all the scores given by different experts. We then make a decision based on these scores s_j: if we want to select a single award-winner or a single faculty candidate, we select the submission with the largest score.

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Conflict of interest situations and how are they usually handled. So9metimes, some experts have a conflict of interest – e.g., such an expert is a co-author of one of the papers considered for the award, or a close relative of one of the nominees; there may be many other reasons, see, e.g., [1, 2].

The opinion of such experts is potentially biased. Because of this potential bias, they are usually excused from the judgment process.

Sometimes, we still need the opinion of experts who have conflict of interest. However, in some situations, this simple solution may not be perfect. For example, in a small awards committee of a broad-range conference or journal, the person with conflict of interest may be one of the few who has expertise is the corresponding subarea. We may not trust this person's opinion about a submission to which he is closely related, but we would like to use this person's expertise when comparing others submissions from the same subarea.

How can we do it?

2 A seemingly natural solution and why it is not fair

What we need. Suppose that we have E experts, and one of the experts i_0 has a conflict of interest with one of the submissions j_0 – e.g., he/she is a co-author of the nominated paper. Since we are interested in i_0's opinions about all other submissions, we ask i_0 to provide the scores e_{ij} for all the submissions except for the one to which he/she is closely related. This way, for all submissions $j \le j_0$, we have opinions e_{ij} provided by all E experts, so we can compute the sum (1).

To be able to compare different submissions, we need to also provide a reasonable score for the submission j_0. For this submission, we only have $E-1$ estimates e_{ij_0} – namely, we only have estimates corresponding to experts $i \ne i_0$. To compute the desired score, we need to provide some estimate for the missing value $e_{i_0 j_0}$. How can we estimate this missing value?

A natural idea. In general, comparing sums s_j is equivalent to comparing averages

$$a_j = \frac{1}{E} \cdot \sum_i e_{ij}.$$

Indeed, each average is simply equal to the corresponding sum divided by E, and if we divide all the values by the same number E, their order does not change.

For all submissions j except for the submission j_0, we have E estimates, but for j_0 we only have $E-1$ estimates. So, a natural idea is to take the average of all these $E-1$ estimates:

$$\frac{1}{E-1} \cdot \sum_{i \ne i_0} e_{ij_0}.$$

Multiplying this average by E, we get an equivalent score

$$\frac{E}{E-1}\cdot\sum_{i\neq i_0} e_{ij_0},$$

which is equal to

$$\sum_{i\neq i_0} e_{ij_0}+\frac{1}{E-1}\cdot\sum_{i\neq i_0} e_{ij_0}. \tag{2}$$

This formula has the same form as the formula (1), with

$$e_{i_0j_0}=\frac{1}{E-1}\cdot\sum_{i\neq i_0} e_{ij_0}. \tag{3}$$

In other words, when comparing submissions, as a missing score $e_{i_0j_0}$, we take the average of the scores e_{ij_0} assigned to this submission j_0 by all other experts.

This natural idea does not provide an unbiased estimate. Let us show that this seemingly natural idea does not work. Indeed, suppose that the expert i_0 assigns very small scores – e.g., the smallest possible score of 0 – to all the submissions $j\neq j_0$. In this case, even if all other experts provide the exact same score e to all the submissions, then:

- for $j=j_0$, the average score is e and thus, the sum score if $e\cdot E$, while
- for all other submissions $j\neq j_0$, the sum score is $e\cdot(E-1)$, which is smaller than $e\cdot E$.

On the other hand, if in the same situation, we excluded the conflict-of-interest expert, all the submissions would have gotten the same score $e\cdot(E-1)$.

Thus, by including the expert i_0 in the decision process, and without explicitly asking his/her opinion about the submission j_0, we nevertheless bias the group decision in the direction of favoring the submission to which he/she is closely related – and this bias is exactly what we want to avoid.

Maybe we can modify the above scheme? To avoid the above situation, we can take, as $e_{i_0j_0}$, the average score of i_0 over all submissions $j\neq j_0$. In this case, assigning 0s to all other submissions will not lead to a bias, but a bias is still possible. To show this, let us consider the case when among the submissions, only two submissions are very good – the submission j_0 and some other submission $j_1\neq j_0$. Suppose that if we only take into account the opinion of all experts without conflict of interest, then these two submissions get equal scores.

Suppose now that i_0:

- assigns good scores to all the submissions except for the submission j_1, and
- to the submission j_1, he/she assigns the 0 score.

Then, we get $e_{i_0j_1}=0$, while as $e_{i_0j_0}$, we take the average of all the scores e_{i_0j}, which is positive. So here, too, taking i_0's opinion into account biases the decision is favor of the submission to which i_0 is closely related – exactly the bias that we wanted to avoid.

So shall we just exclude the conflict-of-interest experts? So maybe the situation is hopeless, and the only solution is to completely ignore the opinions of all the conflict-of-interest experts?

Good news is that there *is* a scheme enabling us to take these experts' opinions into account without introducing the undesired bias. Let us describe this scheme.

3 How to take into account opinion of conflict-of-interest experts without introducing the bias: analysis of the problem

We want to avoid the situations in which the opinions of the conflict-of-interest expert i_0 would bias our decision in favor of the submission j_0 o which he/she is closely related. In other words, in situations in which we decide that j_0 is the best alternative, we should not take i_0's opinions into account.

So, a natural idea is to first decide whether j_0 is indeed the best submission. This has to be decided without taking into account i_0's opinions. So:

- If, based on the scores of all other experts, j_0 is selected as the best option, we just declare it the best option – and this is the end of the selection process.
- On the other hand, if j_0 is *not* selected as the best option, we dismiss j_0 and only consider all other options. In this new process, i_0 no longer has a conflict of interest, so we can take his/her opinion into account.

Thus, we arrive at the following process. The resulting process works no matter how we make the collective decision, whether we take the sum of the scores of whether we make any other comparison.

4 Resulting process

What is given. Suppose that we have a process P that allows us, given values e_{ij} assigned to different submissions j by different experts i, to select one of the alternatives j. This process works when no one has any conflict of interest, and thus, when every expert i provides a score for every submission j.

In real life, some experts i may have conflict of interest with some submissions. In this situation, every expert i provides his/her score e_{ij} only about the submissions for which this expert does not have any conflict of interest.

First stage. At first, we ignore all the experts who have conflict of interest, and make a decision by applying the process P only to experts who do not have any remaining conflicts of interest.

If the first-stage selection results in selecting one of the submissions that have a conflict of interest, we declare this selection to be the final winner.

Possible second stage. If the submission selected by the first-stage selection does not have any conflict of interest with any expert, this means that selections that have conflict of interest are not as good. Thus, the conflict-of-interest submissions can be dismissed from our search for the best submission. So:

- We dismiss all conflict-of-interest submissions.
- Then, to make a final selection, we apply the process P again to all remaining submissions. This time we take into account the opinion of all the experts (including those that originally had a conflict of interest).

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