

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

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

2. Conflict of interest situations and how are they usually handled

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

3. 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 in the corresponding subarea.
- We may not trust this person's opinion about a submission to which he is closely related.
- However, we would like to use this person's expertise when comparing others' submissions from the same subarea.
- How can we do it?

4. 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 .
- We are interested in i_0 's opinions about all other submissions.
- So, 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 $j \neq j_0$, we have opinions e_{ij} provided by all E experts, so we can compute the usual sum.
- 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 $i \neq i_0$.
- To compute the desired score, we need to provide some estimate for the missing value $e_{i_0j_0}$.
- How can we estimate this missing value?

5. 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 .
- 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:

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

6. A natural idea (cont-d)

- Multiplying this average by E , we get an equivalent score

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

- This formula has the same form as the formula for the sum, with

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

- 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.

7. 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 is $e \cdot E$, while
 - for all other submissions $j \neq j_0$, the sum score is $e \cdot (E - 1)$, which is smaller than $e \cdot E$.
- If in the same situation, we excluded the conflict-of-interest expert, all the submissions would have gotten the same score $e \cdot (E - 1)$.

8. This natural idea does not provide an unbiased estimate (cont-d)

- 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.
- This bias is exactly what we want to avoid.

9. Maybe we can modify the above scheme?

- To avoid the above situation, we can take, as $e_{i_0 j_0}$, 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.

10. Maybe we can modify the above scheme (cont-d)

- 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 in favor of the submission to which i_0 is closely related.
- This is exactly the bias that we wanted to avoid.

11. 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.

12. 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 to 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.
 - On the other hand, if j_0 is *not* selected as the best option, we dismiss j_0 and only consider all other options.

13. Analysis of the problem (cont-d)

- 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 or
 - whether we make any other comparison.

14. 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 CoI.

15. Resulting process: first stage

- At first, we ignore all the experts who have conflict of interest.
- We make a preliminary decision by applying the process P only to experts who do not have any CoI.
 - If the first-stage selection results in selecting one of the submissions that have a conflict of interest,
 - then we declare this selection to be the final winner.

16. Resulting process: possible second stage

- What 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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