

# View Review

## Paper ID

7463

## Paper Title

Scheduling with Untrusted Predictions

### REVIEW QUESTIONS

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#### **1. Please briefly summarize the main contributions of the paper in your own words. (Please do not include your evaluation of the paper here).**

The paper has several contributions:

1. From a conceptual perspective, it introduces predictions into the scheduling problem. Thus, the authors consider two problems, subject to minimizing the sum of completion times, where predictions, not the actual and possibly unknown at the beginning of the problem, about the job processing times are used.
  - the scheduling of jobs with arbitrary release dates on a single machine
  - the scheduling of jobs with a common release date on multiple machines
2. From an algorithmic perspective, the authors give algorithms for these problems which use predictions for making their decisions.
3. From a theoretical perspective, the algorithms are consistent. Their competitive ratios are represented as linear functions of the total prediction error. Thus, with accurate predictions, their performance is close to the optimal offline and, with inaccurate predictions, it is close to the optimal online.
4. From an empirical perspective, the authors confirm the theoretical bounds of their two algorithms by conducting experiments on a single machine and multiple machines, comparing their algorithms to the offline optimal ones in these settings, respectively.

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#### **2. What are the main strengths of the paper? Please focus on novelty, soundness, significance and impact, relevance to AI, clarity of exposition, and credibility with regard to reproducibility (as specified in our reproducibility guidelines).**

- Using predictions is a strong point. This has received little prior attention in the context of scheduling.
- Even more, the derived competitive ratios do not depend on the knowledge on how the predictions are made but they are worst-case. As a result, the algorithms are guaranteed to perform better if the distribution of the predictions is known and based on past data about the job processing times.
- The use of detailed examples is much appreciated. These can be used for future work by the relevant community.
- The theoretical results are supported by experiments.

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#### **3. What opportunities are there to improve the paper?**

There is a number of minor improvements:

1. The writing could be improved. I found the following typos:
  - "use predictions for taking their decisions" --> use predictions when making their decisions
  - "in the majority of the literature, these works" --> in the majority of the related literature, research works
  - "However, in our days," --> However, nowadays,
  - "We assume that  $x_j > 1$  for all  $j$ " --> We assume that  $x_j > 1$  for each job  $j$

- "the Round-Robin algorithm is 4-approximate in" --> the Round-Robin algorithm 4-approximates the objective in OR
- the Round-Robin algorithm is 4-approximation of the objective in
- "as the job with have the highest priority" --> as the job will have the highest priority
- "An optimal schedule can be obtain" --> An optimal schedule can be obtained
- "In this section we consider the problem" --> "In this section, we consider the problem"
- "of the tasks, considering the tasks sorted in non increasing order of their predicted values" --> of the jobs, considering the jobs sorted in non-increasing order of the predicted values of their processing times

2. The Round-Robin could be defined in the main text, perhaps informally, on the first page, where it occurs for the first time.

3. The authors should mention that  $C_j$  is the processing time of job  $j$ , before  $C_j$  appears for the first time on the first page.

4. What does "problem  $P|r_j, \text{non-clair.} \sum_j C_j$ " stand for? What does "problem  $P| \text{non-clair.} \sum_j C_j$ " stand for?

5. What is  $J_i$ ? The authors should define  $J_i$  formally.

6. "It is known that the optimal strategy for the objective of minimizing the sum of completion times in the clairvoyant case is to follow the Shortest Processing Time First (SPT) rule when all release times are zero." --> The authors should add a reference to this sentence.

7. The authors could add a definition of a-approximation algorithm for the total completion time, with 2-3 sentences. This will make the paper even more self-contained.

8. The reviewer remains confused by the title "Scheduling with Untrusted Predictions". Why the predictions are untrusted? They might as well be trusted.

9. The reference list can be extended:

- "Online Peak-Aware Energy Scheduling with Untrusted Advice"
- "Non-Clairvoyant Scheduling with Predictions Revisited"

10. Some statements in the related work might be a bit less precise:

- "[Lykouris and Vassilvitskii, 2018] were the first to introduce predictions to improve the performance of online algorithms." --> Do the authors mean in the context of scheduling? In other domains, predictions and advice have already been used earlier to boost the performance of online algorithms., see e.g. "Most Competitive Mechanisms in Online Fair Division". 2017 and its related work section.

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**4. What pressing questions do you have for the authors in the rebuttal ? List (and number) only questions about specific issues here that 1) could directly influence your evaluation of the paper, and 2) do not require providing new results. Typical questions include requests to clarify or justify particular issues, or about important relationships to other works.**

I have three questions for the authors:

As the authors mentioned in the main text, the Round Robin algorithm is 2-approximation of the total completion time on the problem with multiple machines and a common (e.g. 0) release date for all jobs. However, you prove that it is 4-approximation of the total completion time on the problem with a single machine and arbitrary release dates for all jobs.

1. Does this observation mean that the performance of the algorithm worsens when moving from a common release date for all jobs to arbitrary release dates for all jobs?
2. Also, what is the approximation ratio of the Round Robin algorithm on the problem with two or more machines and arbitrary release dates for all jobs?
3. How practical is the assumption of a common release date for all jobs? And, does your results change when moving from 0 as a common release date to some  $t > 0$  as a common release date? If not, why did you use 0 as a common release date?

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**5. Overall assessment.**

Clear Accept. Interesting. A very good submission. I learned a lot from this paper. I vote and argue for acceptance. (Top 50% of accepted IJCAI papers.)

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**6. Justify your score in a few lines. Please focus on novelty, soundness, significance, expected impact, relevance to AI, clarity of exposition, and credibility with regard to reproducibility.**

The problem has not received enough attention. The combination of worst-case results, empirical results, and detailed examples is really helpful. The proofs of the results are simple and can be reproduced easily. The paper is clearly written with minor typos, that can be fixed during the rebuttal phase. From this perspective, the paper is at a small editing distance from the camera-ready version.

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**7. Are the results in this paper easily reproducible ?**

CREDIBLE: I believe that the obtained results can, in principle, be reproduced. Even though key resources (e.g., proofs, code, data) are unavailable at this point, the key details (e.g., proof sketches, experimental setup) are sufficiently well described for an expert to confidently reproduce the main results, if given access to the missing resources.

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**8. Independent of your judgement of the quality of the work, are there any ethical concerns with regard to responsible research or potential negative societal impacts of this submission that must be considered by IJCAI-ECAI 2022 before the paper can be accepted? Papers with a yes here will undergo additional ethical screening by senior members of the program committee. In case of glaring violations of well accepted ethical principles, IJCAI-ECAI 2022 reserves the right to reject the submission. Please check our Ethics Policy in the Call for papers for more details.**

No

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**9. How well does this paper align with your expertise?**

Knowledgeable: This paper has overlaps with my core research focus and I am knowledgeable about most of the topics covered by the paper.

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**10. How confident are you in your evaluation?**

Confident. I tried to check the key points in the paper. It is unlikely, though conceivable, that I missed some important aspects.

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