



LION 6 Status of paper 74

LION 6 <myreview@csregistry.org>

7 December 2011 22:43

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Dear Helga Ingimundardottir, Thomas Philip Runarsson

We are pleased to inform you that your paper entitled "Determining the Characteristic of Difficult Job Shop Scheduling Instances for a Heuristic Solution Method", submitted to LION 6, has been accepted as SHORT PAPER for presentation at the conference and inclusion in the proceedings. Below, you will find attached the reports of the reviewers. Please consider the reviewers' comments carefully when preparing the final version of your paper. This camera-ready version must follow the Springer LNCS guidelines with a 6 pages limit.

In order to submit this final version, you must access the <http://myreview.csregistry.org/lion6//SubmitPaper.php> upload interface and enter your id and password:

Paper id: 74

Password: 8ae2a9.

The camera-ready copy (PDF files only) of your paper is required before 09/01/2012. Before that date, one of the authors of the paper must have registered to the conference - registration is open at <http://registration.net-resa.com/site/696>

Please note that any delay in sending your camera-ready version or registering to the conference may prevent the inclusion of your paper in the pre-proceedings.

Note that the technical details regarding the presentation at the conference will be sent to you later.

Best regards,

LION 6 PC chairs

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Reviewer: 1

Originality : Fair

Quality : Fair

Relevance : Very Good

Presentation : Fair

Reproducibility : Good

Summary: The paper is about finding characteristics of hard job shop scheduling problems. It considers a well-known dispatch heuristic (most work remaining) for the makespan capacity one job-shop scheduling problem. Inspired from this heuristic the authors define 16 problem features. They generate 1500 random problem instances, categorize them as easy, hard (and in-between ...) according to the performance of the selected heuristic relative to a critical path measure. The easy and hard instances are dynamically analyzed w.r.t. the 16 features over the iterations of the scheduling process. They seem to conclude that the impact of the features (on hardness) vary over the duration of the scheduling process. They claim that their approach is easily adaptable to more complex scheduling algorithms.

Details: You should be consistent regarding the acronym for the dispatch rule (MWKR vs. MWRM).

I think you should use a more standard math notation for the JSSP and also introduce a symbol for

operations.

(5) seems to imply that machine m is the machine with the longest makespan?

I think the name 'problem instance' is better than 'data instance'.

The selection of features should be motivated better and explained in more detail. They seem to be closely related to the specific, simple algorithm. Why do you think they say something substantial about instance hardness?

How do you know that the features you have selected give a meaningful analysis?

The characterization of easy and hard is relative to the selected algorithm. Why is this interesting?

The use of names seems a bit sloppy. What does the term 'easy schedule' mean? Is this the same as 'easy problem (data) instance'? A schedule is a solution, not a problem. Does 'hard problem' have the usual meaning as in complexity theory, or do you mean 'hard problem instance'? What do you mean by 'easy or hard data structure'?

p1: differently well -> differently?

p1: but the most effective have been Do you have a reference?

p2: corresponds for finding good and bad -> corresponds to finding good and bad

p2: In [4], they -> In [4], the authors

p2: dependant -> dependent

p2: can two similar schedules yield completely contradictory outcomes, i.e. one poor and one good schedule? This sentence does not make sense to me.

p3: it is a permutation vector, σ , of $\{1, \dots, m\}$. Should this not be indexed by j $\sigma(j)$?

p3: Representing that a job j can be processed -> Representing the constraint that a job j can be processed

p5: there are 17 jobs already scheduled -> there are 17 operations already scheduled (and 6 operations left ...)

p5: for example by assigning jobs with most total processing time remaining
Is this a good example? Why can you not find this through trivial bookkeeping?

p7: $P = \{(p_i, \sigma_i)\}_{i=1}^l$ What is p_i , and what is the relation to $p(j, a)$?

p8: features have different impact on the schedule What does this really mean?

p9: In the caption of tables 3 and for you refer to ρ but I see no reference to ρ .

p9: It is possible for a JSSP schedule to have more than one sequential dispatching representation.
I do not understand, please explain.

p10: Since feature selection is of paramount importance in order for algorithms to become successful I do not understand, please explain.

p10: that equal them in the same measure. What do you mean?

p10: devout -> devote

p10: which needs to be investigate why the sudden change? Rephrase

Candidate for the best paper award? : No

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Reviewer: 2

Originality : Fair
Quality : Weak
Relevance : Fair
Presentation : Below average
Reproducibility : Fair

Summary: This paper studies some characteristics of job shop scheduling problems when using a simple greedy heuristic (MWKR) for deciding the next job to be scheduled. The paper aims to understand which features are important and why, in order to design better heuristics.

Details: What speaks in favor of the paper is that it is one of the few papers studying how features change over time.

What speaks against the paper is that it is very preliminary; it feels like an early draft of what could become a good paper in the future. However, with a total length of 10 pages and the core of the paper, an experimental study, occupying just 2 paragraphs of text and 3 graphs, it necessarily stops short of answering the most interesting questions.

Add 5 pages of experiments answering interesting questions and you have a nice paper...

As it stands, the paper only partly achieves its goals, by determining which features correlate with poor results of MWKR. However, it does not answer the more interesting questions

- Why do those features explain performance?
- Are higher or lower values better for these features?
- Do the features just indicate that poor choices have already been made and that there is no way to still achieve a good result, or do they really capture that "the partial instance is hard for MWKR"? This question could be answered by comparing results for a range of heuristics.
- Do the same features correlate with performance of different heuristics?
- Can better results be achieved by undoing assignments that lead to features suggesting poor performance?
- Does a regression-based performance prediction improve over time with the given features?
- Can better results be achieved by switching between heuristics, or by modifying them?

Overall, the authors ask a lot of good questions in the introduction and in the conclusion, but they do not yet provide a lot of answers.

Most importantly, by restricting themselves to a single heuristic they forfeit the possibility to reason about the key question of how the information gained can be used to design better heuristics.

If the paper is accepted as a short paper I strongly urge the authors to not remove any experiments: the existing experiments are already at the lower end of the spectrum for a 5-page paper. Rather, a lot of the text (especially in Sections 1-3) could be condensed considerably. Alternatively, if the authors have a lot of new experiments they could add those and probably have a good paper for another conference.

Details:

- Page 2: I don't understand the reasoning behind "Thus the interaction ...". Similarly, why do you have to discretize the instance space in the first place?
- I don't understand the description of features 1-4,8,11,12,and 13: features are not machine-dependent or job dependent, are they? Do these features compute means over machines? Or do they maybe relate to the last scheduled job?

- "half-finished" -> "partly finished"
- Some parts of the text seem very preliminary. One example is the last paragraph of page 2 "It is interesting ...": the first sentences of that paragraph do not make sense to me.
- Similarly, in the paragraph preceding that one, the repeated "they" could be replaced by the author names.

Candidate for the best paper award? : No

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Reviewer: 3

Originality : Good
 Quality : Good
 Relevance : Good
 Presentation : Good
 Reproducibility : Fair

Summary: The paper presents an interesting study about the difficulty of instances for job shop scheduling. It is well written and albeit with some shortcomings, it is a good conference paper.

Details: The paper basically studies a very simplistic job shop dispatching rule and 16 key performance indicators, some of them are static and some others are dynamic.

A ton of 6 job 6 machine instances are generated, solved with the MWKR rule and results are analyzed to see which performance indicators affect the heuristic performance.

The study is really interesting and refreshing. However, I have two very major gripes about it. The first one is that very small instances are tested. The authors could compare against lower bounds (instead of Gurobi optimum solution) in order to study much larger instances. 6 jobs and 6 machines is so small that I wonder if all results are relevant. All results could be invalidated in view of larger instances.

Another major gripe is just studying a simplistic dispatching rule. The authors state that the same methodology could be used to study more complex methods but it remains to be seen if the results would hold and/or even if the methodology would be sufficient when faced with more complex methods.

Some other smaller issues:

- 1) I might not have understood table 1 correctly. Bu I am not sure that indicators 1 and 13 are dynamic.
- 2) Figure 1 is ugly, the boxes at the Gantt chart do not have the same height.
- 3) Maybe authors want to say "effectiveness" instead of "efficiency" on line 4-5 of page 2.
- 4) After table 1, the explanation is confusing, jobs are entire jobs, the authors say "there are 17 jobs already scheduled" there are 6 jobs... they mean TASKS. (Jobs are broken down into tasks)
- 5) I am not overly sure about the confidence level on the statistical tests on tables 2-4. The authors are doing statistical testing on 16 different indicators, all of them obtained with the same data at 35 different steps. Every time we do a statistical test on the same data, we have a significance and a confidence level. This might be 5% and 95%, respectively. However, if the same data is used for repetitive statistical testing, it is not true that these stay at 5% and 95%. After all, using the same data, at 5% significance level, 5 out of 100 statistical tests would return a false positive (or true negative, depending on the null hypothesis meaning). The authors need to employ an adjustment, like the Bonferroni adjustment or something similar.

Candidate for the best paper award? : No

