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CC: "Oliver Schulte" [oschulte@cs.sfu.ca](mailto:oschulte@cs.sfu.ca)   
  
Dear Mrs. Riahi,   
  
We are pleased to inform you that your manuscript, "Outlier Detection for Object-Relational Data Based on Graphical Models", has been accepted for publication in Data Mining and Knowledge Discovery subject to you making required changes by [28 Jul 2019](http://airmail.calendar/2019-07-28%2012:00:00%20PDT).   
  
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We look forward to receiving your revised manuscript.   
  
  
Best regards,   
  
Keerthana Govindarajan   
JEO Assistant   
Data Mining and Knowledge Discovery   
COMMENTS FOR THE AUTHOR:   
  
\*\*\*\*\*\*\*\*   
  
Dear Fatehmeh Riahi,   
  
Based on the assessment of the reviewers and action editor (see letter below), your paper has a good chance of being accepted for publication in Data Mining and Knowledge Discovery. Congratulations!   
  
However, before it can go into production, please take some time to make sure that your manuscript is ready for printing. In particular:   
  
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best regards,   
  
Johannes Fürnkranz   
Editor-in-Chief   
Data Mining and Knowlege Discovery   
  
  
Dear all,   
  
Thank you for your submission to DAMI. I am delighted to accept it for publication, subject to completion of rather minor revisions, which are stated in the corresponding reviews. As one of the reviewer states it, "this revision is a major rewrite and fixes   
the main issues with the previous versions."   
  
I look forward to receiving your revised manuscript.   
  
Yours sincerely,   
  
Kristian Kersting   
Action Editor   
  
Reviewer #1: I think that this paper presents a nice piece of work and deserves to be published. I commend the authors on their revisions.    
  
My only minor quibble is that in Section 10 for the sports examples, a number of the features are raw counts, which are clearly correlated with playing time. Hence some of the correlations may simply be explained by that. 

[added explanation addressing this point above table 14. See paragraph: “discussion of success metrics”]

Time played is reasonable to consider, but it also depends on things like injuries and what competitions a team plays in (e.g., resting a good player in the league ahead of a champions league game).    
  
I think it is worth commenting on this or at least adding this caveat to the discussion.

[acknowledged and added references to state-of-the-art player performance metrics that address the issue of isolating individual performance from context factors. See paragraph: “discussion of success metrics”]  
  
Minor points   
  
In the intro and conclusion you use 'log likelihood distances' but in rebuttal and the middle you talk about expected log ... to explain the ELD. I'd be consistent.

We went through all occurrences of log-likelihood distance and either added “expected” or rewrote to avoid mentioning the full “expected log-likelihood distance term” (which is a bit of a mouthful).

The following are smaller local which we fixed.

P3: relational data[21,50,13] -> needs a space between data and the cites

fixed  
  
P3 I think the 'quality measure' should be in \emph{} for consistency 

fixed

P3 fits fits

fixed  
  
P4 I think the 2 contributions would read better if written as complete sentences particularly given that they are structured grammatically that way

fixed  
  
P5 'from different data models,' -> from two different data models:

fixed  
  
P6 "the survey by [38] -> I found this sentence very long

broken up  
  
P6 The Distance-based -> The distance-based

fixed  
  
P6 "are far and isolated' -> do you mean far away?

Yes, rewritten  
  
P8 shows example -> shows an example

fixed  
  
Tables 2 & 3 are not particularly consistent (e.g., last row & last column do not have ..., last row of 3 has WA...

made consistent. The only difference now is that Table 3 has WA because all its entries have WA. This is also noted in the caption.  
  
p9 Fix a set... -> this sentence reads a bit oddly to me

rewritten (see Section 3.2)  
  
You often write Wigan Athletics, but I think it is Wigan Athletic

thank you Fixed  
  
P13 Therefore, Bayesian -> Therefore, the Bayesian

fixed  
  
P16 I am not sure I'd say strengths and weaknesses because it focuses on the other metrics, and does not illustrate weaknesses of your metric. Nonetheless I find this section very very interesting and illuminating. 

rewrote a bit to avoid misleading expectations

P19 to empirical -> to the empirical

fixed  
  
P19 defined a single -> a word seems to be missing here

changed to “defined over a single”  
  
P19 needs a \noindent after eq 9

fixed  
  
P19 by by

fixed  
  
P25 AUC is, 1 -> AUC is 1

rewritten to “The maximum value for $\auc$ is 1.0”  
  
P25 of normal community -> sentence is a bit unclear to me 

rewritten to “When comparing two individuals with only two binary features, $\it{RIBL}$ assigns to each individual, the same distance from the center of a normal population.  
P27 if you could cite to some article that states that Dzeko is a good dribbler that would be cool & strengthen your argument .”   
  
P30 than normal -> than the normal

fixed  
  
P30 in Premier -> in the Premier

fixed   
  
**Figure 11, can you say what the salary and time scales are? E.g., is the salary per game, per year, per week?**  
P34 in Forwarder -> in the Forwarder

fixed  
  
Figure 12 has no caption and same point about time units

added thank you  
  
In the appendix having some text before you jump into the proofs would be good

added transition text  
  
**Cite 56 seems off**  
  
Reviewer #2: This revision is a major rewrite and fixes the main issues with the previous versions. In particular, the paper now takes the angle of presenting a framework for exception mining in relational data. The ELD measure is an additional contribution, one which is evaluated alongside likelihood ratio (LR) and log-likelihood (LOG). The theoretical analysis showing the relationship between ELD and TVD is also nice, as is the discussion of when LOG works better for detecting success. I think it's interesting that LOG works well for detecting success but very poorly for differentiating classes.   
  
The remaining issues are minor, such as copy editing details and some clarifications.   
  
**I think that some of the text is unnecessarily verbose, but it's probably safer to err on the side of too much detail.**  
  
The example in Section 5.2 shows that LR has both positive and negative terms, but it doesn't show meaningful consequences of that difference. Both of them report a positive value for the outlier, but they're on different scales, so it's hard to compare. It would help to show a pair of examples, x1 and x2, where LR ranks x1 as more unusual and ELD ranks x2 as more unusual. 

Figure 8 gives an example where LR gives the same value for a normal and an outlier, but FD (and hence ELD) distinguishes them. See disussion around “While log-likelihood LR is a good baseline score for detecting outliers, it fails to detect some clear outliers, as shown in Figure 8” In general, the strength of ELD is not best shown in single cases, but that it provides scores that are further apart, making it easier to set a threshold to separate a set of outliers from a set of normals, rather than distinguish a particular case.

In Section 6, what does the second-order term look like for the Taylor expansion of ELD? It's interesting that TVD is a first-order approximation of ELD, but the second-order term could change its behavior substantially. Since LR is being analyzed via a second-order Taylor expansion, it seems appropriate to at least look at the second-order term for ELD.

Added an explicit formula for the second-order term (see Proposition 2)

**In Section 8.2, I didn't quite follow the explanation of why RIBL fails in Table 10. This is minor, because I imagine that studying the details of RIBL from the original paper would clarify it.**  
  
In Section 10, the justification for focusing on ELD is reasonable -- LR performs worse, and LOG only occasionally performs better. However, it would help to have some mention of this early on in the section, instead of just at the end.

Actually alternative metrics, such as LR and LOG, are mentioned in Section 10.1 at the beginning with a forward pointer to 10.3. We’ve expanded the forward pointer at the end of Section 10.1 so it’s not missed by the reader.  
  
TYPOS, GRAMMAR, AND OTHER SENTENCE-LEVEL ISSUES:   
  
(NOTE: This isn't necessarily a comprehensive list, but includes the ones I happened to notice and mark while reading through.)   
  
Abstract: "A object" --> "An object" .

fixed  
  
P.2: "each team comprises a set of players for that match" -- this sounds a bit odd; normally a team includes all players, even those that didn't play in a particular match. Is there a different word or phrasing that could be used here?

Changed to “fields a set of players”  
  
P.3: "relational data[21,50,13]" --> "relational data [21,50,13]"

fixed  
P.3: "model fits fits an input"

fixed  
P.5: "field, for a survey please see" --> "field; for a survey please see" (looks like a comma splice to me, but very minor)

fixed  
P.6: "The Distance-based" --> "The distance-based"

fixed  
P.8: "grounding count, divided" --> "grounding count divided" (I'd remove this comma, but that's very minor)

fixed  
P.12: "For the notations" --> "For the notation"

fixed  
P.13: "Therefore, Bayesian network" --> "Therefore, the Bayesian network"

fixed  
P.19: "can omit this section without loss of generality" -- I don't think the expression "without loss of generality" makes sense here

changed to “loss of continuity”  
P.19: "defined a single discrete random variable" --> "defined over a single discrete random variable"

fixed  
P.21: "wolrd" --> "world"

fixed  
P.21: "data set" "dataset" -- dataset can be one word or two, but it should be consistent

now always “data set”  
P.25: "are the only scores that achieves" --> "are the only scores that achieve"

fixed  
P.26: "works better than RIBL or equally good" --> "... equally well"

fixed   
P.26: "with precision@r% another metric" --> "with precision@r%, another metric"

fixed  
P.28: "belog to forward group" --> "belog to the forward group"

rewritte to be “players are forwards”  
  
  
  
OTHER PRESENTATION ISSUES:   
  
Capitalization is somewhat inconsistent. When discussing a method that also has an associated abbreviation (e.g., "Bayesian networks"), I recommend capitalizing the proper nouns (e.g., Bayes, Bayesian, Markov) and leaving all other letters lowercase. This paper uses a mix of capitalization strategies. Some words follow this approach ("Bayesian network", "Kullback-Leibler divergence") and others do not ("Exceptional Model Mining", "Markov Logic Networks"). I imagine the final style is determined by the journal, but it should be consistent throughout in any case.

We switched to lower case except for proper nouns, as you suggest  
  
Figure 4 and 5 have inconsistent typefaces.

Fixed (both Calibri now)  
  
Table 5 references Figure 7. Could Figure 7 come first?

It does (Figure 7 on p.17, Table 5 on p. 18)  
  
**The text in the graphs is mostly readable, but could be even larger. (e.g., Fig.11)**  
  
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