Reviewer's report

Title: Machine learning can predict survival of patients with heart failure from serum creatinine and ejection fraction alone

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Reviewer: Slade Matthews

Reviewer's report:

The authors have performed an analysis and machine learning study based on published data on 299 patients with heart failure collected in 2015. The introduction explains the importance of cardiovascular disease in the world population and heart failure in particular. The definition of two types of heart failure based on ejection fraction in paragraph two could be made clearer because the "ratio of blood pumped out of the heart during a single contraction" probably should say "proportion of blood" not ratio to be clear.

In Section 2: Dataset the patient parameters and the target outcome are described. The outcome of interest is survival at follow-up which averaged at 130 days. The authors really should give the range of values and standard deviation to give readers a sense of how representative the 130 day average really is of this outcome. This is particularly important since this is the defining outcome and target of the models.

Section 3.1 explains the machine learning methods that were employed in the present work. What implementation was used here? For example did you use R, python, weka or some other tool?

Section 3.2 describes the feature ranking of the dataset. The authors describe the interpretation of the Wilcoxon and the Chi-square test as being based on a "low score" means that the features have a "strong" relationship… The so called "score" is clearly meant to indicate the p-value associated with the given statistic being calculated in the test. This section should be made clearer. The values determined in the tests should be (in my opinion) included in tables 5 - 7. For example the Chi-square test when calculated gives a Chi-square value and this can be compared to a table of Chi-square values which includes number of degrees of freedom down the table and alpha level along the rows. Calling the p-value a score does not correctly represent what has been done here.

Section 3.3 describes the feature rankings but also describes the allocation of patterns into training and test sets. It is not clear from this section how the balance of target class proportions was maintained in this process. Were patients randomly allocated to these datasets? Was the data imbalance carefully maintained in the training and test sets and if so - how?

Section 4.1 explains how the different machine learning algorithms performed on the complete dataset before the generation of the final models which only incorporated creatinine and ejection fraction. One thing I found confusing here was the statement that each method was applied 100
times. I would like a little more clarity about how this was done. For example were the datasets regenerated each time, so that the method would be similar to 10 repeats of 10-fold cross validation? I just think this needs a tiny bit of tightening up. In table 4 the top performer was highlighted in blue - could this also be starred since some people still print in b&w.

Section 4.3 line 62 "predict patients" s/b "predict patient's survival" since that is what is being predicted.

Section 4.4 line 52 "its status" s/b "survival status" that way you get around the awkward issue of calling patients "it".

Section 5 Discussion. This section states how useful it is that only two parameters are required to get a reliable prediction of survival in the clinical setting. It would be a nice touch to include how this information would be used by clinicians to change approaches to patient care.

Overall I found the paper very well presented and it was mostly pretty clear how the authors had approached the problem.

**Are the methods appropriate and well described?**
If not, please specify what is required in your comments to the authors.

Yes

**Does the work include the necessary controls?**
If not, please specify which controls are required in your comments to the authors.

Yes

**Are the conclusions drawn adequately supported by the data shown?**
If not, please explain in your comments to the authors.

Yes

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