Conference Paper Review

Paper ID: 003
Title: Neural CDEs as a Solution to Irregular HER Data in 30-Day Unplanned Heart Failure Readmission Prediction*
Author(s): Ryan Missel

Reviewer's Recommendations:

i. **Writing**
   - Well written

ii. **Novelty**
   - Original

iii. **Suitability**
   - Very related

iv. **Reviewer's Expertise**
   - Passing interests

v. **Recommendation**
   - Absolute accept

Reviewer's detailed comments: strength, weakness, suggestion

i. **Comments for the Authors:**

   a. **Strengths**

   The Abstract is very well written and covers all the research's objectives, contributions, and significance in a well-organized structure. The motivation for the CDE method proposed is explained well. Likewise, the code and detailed specifications have been provided for reproducing the results.

   Also, the limitations and contributions in the previous related works have been explained clearly in detail. The detailed descriptions of the data source and dataset have been given. Furthermore, the modifications and filtering, and process involved to produce the final dataset have been well justified.

   The features have been well defined and categorized accordingly into demographics, time series, chronic with justified explanations, and figures provided. Likewise, the selection of features like insurance type has been explained well by showing the correlation of insurance type to readmission prediction due to early discharge. Biasness and imbalance in the data also have been analyzed.

   Moreover, a wide variety of models have been explained and evaluated with examples, including the feature representation of each model and its steps.

Results are well tabulated and explained, with a comparison between different models. Additional points and future works to address the current limitations have been well written.

b. Weaknesses and Suggestions

The use of acronyms in the title should be removed. The first two sentences of the Introduction section are the same as the Abstract. In many portions, tables, and description in different pages.

A suggestion is to mention a single line summary of the paper instead of mentioning the reference numbers alone, in the last paragraph of section 1.2.

A figure for feature representation for the CDE model, like other models, could make the explanation easier.

Page number with author name was a little misleading, especially in the last page (references)

ii. Comments for the Program Committee (will be kept confidential and NOT released to the authors)

The paper is well written and contains a detailed explanation for all the methods and solutions. Likewise, it has made significant contributions by proposing neural CDE to predict heart failure patients' readmission. This is the best paper among all the papers I have reviewed.

Journal Paper Review

Paper ID: 003
Title: Neural CDEs as a Solution to Irregular HER Data in 30-Day Unplanned Heart Failure Readmission Prediction*
Author(s): Ryan Missel

Goals and Contributions:

i Do the authors clearly state the research goals of the work?

The Abstract is very well written and covers all the research's objectives, contributions, and significance in a well-organized structure

ii Does the paper clearly indicate what the contributions are?

Yes, the paper clearly indicates the contributions in proposing a Neural CDE application on HF readmission prediction that demonstrates state-of-the-art results.

iii Are the claimed contributions original and significant in terms of

- Novel methodology?
- New applications?

The contributions are original and significant in terms of a novel methodology of using Neural Controlled Differential Equations on HER data to predict heart patients' readmission.

iv Does the paper describe the methods in sufficient detail for readers to replicate the work?

The explanations of the methods and datasets are well written in detail, enough for readers to replicate the work. Also, the code and detailed specifications have been provided for easily reproducing the results.

Evaluation:

i. Do the authors carefully evaluate the approach?

The approach has been carefully evaluated by comparing the performance and theoretical analysis of a wide variety of models.

ii. Does the paper include systematic experiments, a careful theoretical analysis, or give evidence of generality?

The paper includes systematic experiments, grouped into different categories like regression models, deep sequence models, and neural CDE models. The results have been calculated, maintaining the same number of parameters for both LSTM and Neural CDE models for fair comparisons between them.

Discussion:

i. Does the paper discuss relevant earlier works, noting similarities, differences, and progress?

The limitations and contributions in the previous related works have been explained clearly in detail.

ii. Does it discuss the limitation of the approach as well as its advantages?

Yes, the limitations like bounded time interval and requirement of additional research for validation as a potential application have been discussed. Likewise, the advantages of the approach have been mentioned in the paper.

iii. Does it consider the implication of the work and outline direction for future work?

Yes, it considers the work implication and outlines the direction for future work in utilizing the rough path controls in generating the data controls used by the CDE models as well as the potential of a transformation of the CDE model into a probabilistic model have been discussed.

Presentation:

i. Is the paper adequately organized and well written?

Yes, the paper is properly organized in terms of structure. It has been divided into standard sections. Also, the paper is very well written.

ii. Is the paper grammatically correct and free of spelling errors?

The paper is grammatically correct and free of spelling errors.

iii. Does it use standard terminology?

Yes, all the terminology used in the paper were standard.

Detailed Comments:

The Abstract is very well written and covers all the research's objectives, contributions, and significance in a well-organized structure. The motivation for the CDE method proposed is explained well. Likewise, the code and detailed specifications have been provided for reproducing the results.

Also, the limitations and contributions in the previous related works have been explained clearly in detail. The detailed descriptions of the data source and dataset have been given. Furthermore, the modifications and filtering, and process involved to produce the final dataset have been well justified.

The features have been well defined and categorized accordingly into demographics, time series, chronic with justified explanations, and figures provided. Likewise, the selection of features like insurance type has been explained well by showing the correlation of insurance type

to readmission prediction due to early discharge. Biasness and imbalance in the data also have been analyzed.

Moreover, various models have been explained and evaluated with examples, including the feature representation of each model and its steps. Results are well tabulated and explained, with a comparison between different models. Additional points and future works to address the current limitations have been well written.

The use of acronyms in the title should be removed. The first two sentences of the Introduction section are the same as the Abstract. In many portions, tables, and description in different pages.

A suggestion is to mention a single line summary of the paper instead of mentioning the reference numbers alone, in the last paragraph of section 1.2. A figure for feature representation for the CDE model, like other models, could make the explanation easier. Page number with author name was a little misleading, especially on the last page (references)

Recommendation:

The paper could be published after minor revision, with no further review required.