Weekly recap

**TITLE:**

**Alg-E: Inclusive, interactive, and interpretable machine learning methods for medical applications**

**Abstract**

**Background**

**Aim**

**Objectives**

**Methods**

**Results**

**Discussion**

02/10/2020

**To do:**

-        In subject part: Need to redefine Alg-E (look at L. Bifano’s thesis)

-        In subject part: did not include “management” objective

-        In aims and objectives: need to be more precise about the methods used especially in interpretability (but can’t really fill that in just yet)

-        In both: did not include the possibility of having “real-time” data from the e-POCT results in Tanzania (will know if available soon enough)

-        In both: merge the first sentence of “subject” and the “aim” part

**Title:**

Interpretability of Machine Learning algorithms using e-POCT data for clinicians and validation of the Alg-E platform models

(take a look at title above)

**Subject:**

This thesis aims to better the interpretability of Machine Learning (ML) models – including black box models – in order to generate results and behaviors that are more easily understood by clinicians and therefore generalize, widen and give more credibility to the use of ML models in the medical field (especially in the precise field of medical diagnostic).

Interpretability of ML models will be explored at different levels; at the data level, at the model level and at the output level and will be done through different interpretability and visualization techniques (exploring probabilistic space of the model, intelligent descriptive statistics, confidence intervals for results).

This thesis will also provide a validation test of the Alg-E platform through the use of a dataset pertaining to Ebola infection cases in Tanzania. The models used will be carefully analyzed in order to find insights on a list of important (non-exhaustive) questions) and therefore validate the platform. The models and results themselves will be validated and benchmarked using another set of models and results.

The Alg-E platform is a web-based platform that allows users to upload tabular data in order to output clinical decision algorithms.

The end goal is for clinicians, the end-users,  to be able to give criticism concerning the platform and alter it to evolve in that direction.

**Aim:**

To improve the interpretability of the ML models used in the Alg-E web platform at different levels in order to give more credibility to the use of ML models for e-POCT data.

 then to use these methods as well as comparison to state-of-the-art models to validate the Alg-E platform models and their clinical interpretation.

Trustworthiness through interpretability/interaction/inclusivity/validation

* Validation is part of the gain-of-trust process → merge both “objectives” into one

**Objectives:**

-        Review the literature of interpretable methods in the field of ML applied to medicine and other available tools and demonstrate the need for improvement in that domain.

-        Manage the Alg-E web platform and ensure integration of different team members’ work into the platform and map the communication and development flows.

-        Improve interpretability of the platform results through visualization techniques, understand the clinicians’ requirements for interpretability of data, models and results then implement changes addressing these. There are two main layers to this approach. In a first part a survey of end-users’ expectations will be conducted in order to understand the necessary changes. In a second part, the system itself will be probed and analyzed, using descriptive statistics, confidence intervals, visualization techniques and quantification of uncertainty.

- actually it’s the other way around: create statistics then see if clinicians like it

-        Validate the platform models using a dataset pertaining to Ebola, then validate the results using another set of models used on the same dataset and finally validate the clinical aspect of results through clinicians’ expertise.

**Timeline:**

EXACT DATE (thesis hand in)

Fix the timeline

Get in touch with Alg-E team (Asap, Tuesday 6th)

Research interpretability (finish book + still 3 papers to read, then will be ongoing during the thesis) – Tuesday 6th

Finish reviewing literature – Tuesday 6th (although more papers will be coming in)

Take notes + write results on these in an organized (not totally formal) way (Tuesday 13th)

Interpretability methods investigation (start on Tuesday 6th)

Get in touch with clinicians (After interpretability shenanigans / during)

Build ML model for Ebola dataset (start on Tuesday 20th ?)

Validate other models for Ebola dataset (in parallel of previous task? Tuesday 20th?)

Write the thesis (start 1 month prior to deadline to get a feel of what needs to be done still)

3rd

Comm / slack stuff

* Anything I didn’t address?
* People missing who should be in there?

Alg-E Project:

EPFL MLO Alg-E lab team:

·       <https://github.com/epfl-iglobalhealth>

·        YOU:<https://github.com/epfl-iglobalhealth/Alg-E-sandbox>

·        Antoine (multiclass):<https://github.com/epfl-iglobalhealth/AlgE-multiclass>

·        Lia (overall):<https://github.com/epfl-iglobalhealth/Alg-E>

·        Kuan (unsupervised maps): coming...

·        Zeineb (unsupervised maps):<https://github.com/epfl-iglobalhealth/AlgE-Map>

·        Tristan (cumulator carbon footprint):<https://github.com/epfl-iglobalhealth/cumulator>

Goals of the slack channel + collaboration:

-        Be aware of the project as a whole

o   Where the project is going:

§  Data collection as of now

§  New inputs: should we integrate… images and ultrasounds (lung)?

§  Different platforms for different POCTs? Or 1 giant platform?

o   What other team members are currently doing: see above

o   Feedback / ideas are greatly appreciated: where do you think the project should go? What definitely needs to be done?

-        Be aware of the ongoing development, major discoveries and possible hick-ups: basically anything you think people should know

o   Any major news to the project →  Annie / I  will share

o   Any major news to your project / change your subject →  share

o   Something that can help the team / gives insight on the project as a whole or on someone else’s project / anything you think people should know →  share

-        Need advice / any resources concerning someone else’s subject →  ask

-        This is not a substitute for the numerous slack channels already there

o   Try to keep stuff related to this project only

What I’m asking you to do:

-        A two line description of what your project is / your thesis title

-        Mine: Interpretability of Machine Learning algorithms using e-POCT data for clinicians and validation of the Alg-E platform models

o   1 part interpretation of ML models

o   1 part validation of models on the platform

OTHER stuff

-        Slack team check out what I had in mind

-     num num data: access to dataset (need to sign CDA probably) so I can get working on the code

-        Done with current lit rev, only need to get some stuff written now I think

o   Any additional papers you have (not that you need to find – anything you have right now)

o   Should probably read some more stuff about state of the art so I can write the background

-        Alge platform:

o   should be able to choose different metrics at once.

o   Maybe have a entire left tab for basic explanation? Plus little questions marks that have pop ups, but pop ups take too much space à redirect to that tab.

o   Should have a “fill this first” before you can fill next fields explanation

o   Possible new interpretation results

§  Shap: computing takes too much time? LIME, partial dependence plots? Remains the best insight I know.

§  Model internals, hyperparameter explanation and limitations

§  CI

§  Result visualization: grouping of results?

§ integer rounding issue?

-        Including other stuff on alge:

o   Would need more specifications about what type of data is acceptable for images and sounds…

o   Should probably go for it

-        Hand in thesis on : 22.01.2021: all good on calendar

Todo:

* Write background
* Continue reading stuff
* Start coding
* Look at the alg-e platform code some more
  + Also take notes on model hyperparameters / etc for comparison