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Problem and Solution Documentation Template for Machine Learning Competitions to Enhance Explainability, Reproducibility, and Collaboration Between Stakeholders

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Abstract

Democratizing access to Artificial Intelligence and truly utilizing it for the common good requires multi-stakeholder AI competitions focussed on real and prevalent problems with the potential for large scale impact and that promotes and ensures the explainability, reproducibility, contextualization and incremental enhancements of solutions. We propose a solution documentation and problem documentation template for AI/Machine Learning competitions that ensures the identification and systematic characterization of prevalent problems and the documentation of developed solutions in such a way that they can be easily utilized by anyone anywhere.

Introduction

Adoption of Artificial Intelligence (AI) has significantly accelerated over the last five years, unfortunately, those realities are not very evident in emerging markets which include some of the worlds' poorest countries because the technology is still majorly a black-box model. This makes solutions difficult to access, reproduce, contextualize or enhance especially in countries from Africa preventing these regions from truly benefitting from the possibilities and economic dividends that AI provides (Morris, 2020).

Democratizing access to AI requires competitions on AI for Common Good that promote and ensure the explainability, reproducibility, contextualization and incremental enhancements of solutions (Haughton *et al.*, 2019). Tatman et al., (2018) identified missing or incomplete information as a major factor that made reproducibility of a machine learning research work impractical. Having a solution that not only has high accuracy but is also reproducible, explainable, fair, and secure are critical to increasing users' acceptance and trust in AI solutions (Arnold et al., 2019).

Berendt (2019) identified the pitfalls and challenges of AI for Common Good in the areas of problem-identification and solutionism mindset of the problem solvers, the difficulties of integrating different stakeholders, the role of knowledge, and side effects and dynamics after an exploratory study of 99 contributions to conferences on related fields.

In this paper we propose two templates for AI competitions and other AI for Common Good initiatives to address the problems described above:

- Problem documentation template for local problem owners to identify and document real and prevalent problems in their environment, providing guides/suggestions to solution builders/developers on how to build solutions using AI. This was done with the understanding that AI is not a silver bullet; without understanding and systematic characterization of the problems in the context of the end-users, solution developers would only be grasping straws.
- Solution documentation template for solution developers based on extant literature and best practices to facilitate explainability, reproducibility, contextualization and incremental enhancement of solutions built.

Solution Documentation Template

The solution documentation template was designed for thorough documentation of AI solutions by the solution developers and is based on extant literature and best industry practices to facilitate explainability, reproducibility, contextualization and incremental enhancements of solutions. It comprises 10 sections which include, Statement of Purpose, Dataset, Model, Evaluation, Result, Environment, Steps to Reproduce the Solution, Safety, Security, and

Links. All sections have questions that might arise given a solution, and response expectations are provided where necessary, also some of the sections have subsections.

The dataset section was reproduced from Datasheets for Dataset, a comprehensive documentation template for datasets proposed by Gebru et al., (2018). Most of the Statement of Purpose, Safety, Security, and Model sections were adapted from Factsheets, a documentation sheet proposed by Arnold et al., (2019) to help increase the trust in AI services. Some parts of the Model and Result sections were adapted from The Neural Information Processing Systems (NeurIPS) Machine Learning Reproducibility Checklist and part of the Model section was from Model Cards for Model Reporting, a research work by Mitchehell et al., (2019). The Steps to Reproduce was adapted from the research by Tatman et al., (2018).

Problem Documentation Template

The problem documentation template comprises 5 sections which include, Problem Statement/Definition, Existing Solutions, What needs to happen to address the problem, Possible AI solutions and Impact

Impact and Challenges

The problem documentation template was used in the AI Commons project in Nigeria and Ghana by problem owners to document 25 problems at the problem documentation phase and also at the hackathon phase. The documentation template proved very effective in providing the problem solvers with the understanding and guidance needed to build solutions. This became more apparent as the adjudged top 3 solutions by high profile judges were directly inspired by solution suggestions from the problem documents. The solution documentation template was used in the AI Commons health and wellbeing hackathon in Nigeria by the participants. The judges confirmed all solutions submitted appropriately using the template were highly reproducible and explainable. A usability survey carried out on the templates shows that users find the template easy to understand and use although they noted that it could be time consuming to fill.

Problem documentation template:

<https://drive.google.com/file/d/1xFPGjsEwQ6NIifSQyrX0Ou6XeamLozK5/view?usp=sharing>

Solution documentation template:

<https://docs.google.com/spreadsheets/d/19nYFIAJW2flbZiYsJdMq9o1lu0ppdm091PdZu2Ujdo8/edit?usp=sharing>

Conclusion

The first step of effective problem and solution ideation is how documentation is done. To support documentation for Machine Learning Competitions, Our work presented an open source template that enhances explainability, reproducibility and collaboration. This template has been tested and used in live projects and it has been found to be useful and effective.

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