Research Proposal and Preliminary Bibliography

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Last week, I expanded my research into the role of decentralized machine learning resources, as they relate to monoclonal antibodies use against the COVID-19 pandemic.

**Research Proposal**

I propose that our organization invest in Platform as a Service (PaaS) architectures to create a distributed machine learning software hypervisor that will allow individual users to contribute their PC’s raw processing power or user’s individual machine learning analytic techniques in the fight against the COVID-19 pandemic. I have chosen to address this topic so that I might further my understanding of the power of cloud-based information systems, and their usefulness to global societies fight against this virus which is having unprecedented affects all people’s day to day lives. For this reason, we are all the stakeholders who have an interest in this issue and while the audience for this would ideally be as wide as possible, realistically, it will only be taken into consideration among avid computer users with above-average skills in distributed computation. Being able to make a difference in this regard will depend on the success of creating a simple and popular user interface for regular PC users, and a more nuanced user interface for power users of the cloud. I have already narrowed this topic down from a paper whose purpose was to include detailed descriptions of individual machine learning algorithms that could be useful in this fight, as this information can be widely found on the web for those familiar with the subject. If I needed to narrow the topic more, I could focus solely on the donation of an individual’s processing power and not write about contributing individual algorithms towards the effort. This topic is debatable for the following reasons:

1. Wouldn’t it be better to use the established cloud services that can provide these services instead of creating new Software as a Service (SaaS)?
2. Even if this effort becomes popular, how much processing power can be gathered and are these enough resources for the challenge at hand?
3. There are so many different supervised and unsupervised machine learning algorithms to choose from, how can I choose the right one for this purpose?
4. How does the role of personally identifiable information play into the role of detection of specific monoclonal antibodies that would mark an individual as immune to the virus?
5. What might the regulatory implications of personally identifiable health data be and how might we address them?

There are strengths and weaknesses in reviewing the literature regarding this topic. One strength is that distributed computational processing power is a well-documented science, and there are plenty of credible peer-reviewed factual sources regarding the cost benefits of using peer-to-peer processing, over established cloud infrastructure corporations. A drawback of writing about any current event is that the landscape is rapidly changing, and new research is being produced that has not had a thorough peer-review process. Thankfully the primary sources I will be using regarding treating COVID-19 with monoclonal antibodies are written to an academic standard with other high-quality sources cited in the text.

References

Blackburn, G. M., Kang, A. S., Kingsbury, G. A., & Burton, D. R. (1989). Catalytic antibodies. *Biochemical Journal*, *262*(2), 381–390. doi: 10.1042/bj2620381

This article in the Biochemical Journal is one of the first published papers regarding the creation and use of monoclonal antibodies for the treatment of disease in humans. The article is intended for individuals who are conducting their own research into the benefits of this applied technology.

This source, although written over 30 years ago still brings value to this research project in that it highlights the course of thought that has brought us to the modern area of research into monoclonal antibodies. The research by Blackburn et. al is of a high degree of referential integrity as it has been peer-reviewed for over 30 years. The original research has enabled countless breakthroughs in this field and deserves to be mentioned as we would not be where we are today without it. One advantage of referencing such an old test is that it gives the researcher insight into the history and development of the scientific discipline. One disadvantage of using this source is that some practices have been replaced with modern techniques. It is still important to reference this research a none of the modern techniques we use today would be possible without it.

Folding@Home. (2020). Covid19. Retrieved March 29, 2020, from <https://foldingathome.org/covid19/>

This is the home page for a popular project for individual users to donate their home computer’s processing power to aid in the fight against the COVID-19 pandemic. Users Central Processing Unit (CPU), and Graphical Processing Unit (GPU) are donated to research on unique viral protein folding potentialities.

This is a primary source that will be the model for the cloud platform deployment that is recommended in this paper. This is a high-quality source because the individuals who are publishing content are the people responsible for bringing this idea to life. A strength of this publication is that it is a primary source, and can be used as a model for improvement. Weaknesses of this platform include the requirement to download an executable file in order to join in the protein folding tasks. This model could be improved by hosting the application over the cloud so that individuals do not need to download an executable file on their computer.

Hifumi, E., Taguchi, H., Tsuda, H., Minagawa, T., Nonaka, T., & Uda, T. (2020). A new algorithm to convert a normal antibody into the corresponding catalytic antibody. Science Advances, 6(13). Retrieved from <https://advances.sciencemag.org/content/6/13/eaay6441>

This is a fascinating article that was recently published in the Journal of Science Advances. The article describes machine learning algorithms in-depth, as they relate to the deletion of the PRO95 enzyme when creating catalytic monoclonal antibodies.

This is a high-quality source, as it was published by a research team dealing with machine learning algorithms in the production of catalytic monoclonal antibodies. The source is peer-reviewed and published in an academic journal. This source will be a good reference as to what types of machine learning algorithms have been tested in a labratory research context. One of this reference’s strengths is that it is a recently published, peer-reviewed journal publication. One of these reference’s weaknesses is that it is written at a very high level and needs to be paraphrased into more understandable writing.

Hwang, K., & Chen, M. (2017). *Big data analytics for cloud computing: a cognitive machine learning approach*. Chichester, UK: John Wiley & Sons.

This is another high-quality source, a textbook that describes in-depth the different styles of machine learning algorithms, how they should be tuned, and what kinds of results can be expected.

This is a research-quality textbook in that it does not omit the high-level mathematics involved in creating and using both supervised and unsupervised machine learning algorithms. This textbook is peer-reviewed and cited widely across the field of its subject. A strength of the book is that it provides detailed information about how machine learning algorithms can be applied to sensitive healthcare data, and how to work with personally identifiable data. A weakness of this text is that it describes high-level mathematics outside the scope of this research project.

Wang, C., Li, W., Drabek, D., Okba, N. M., Haperen, R. V., Osterhaus, A. D., … Bosch, B.-J. (2020). A human monoclonal antibody blocking SARS-CoV-2 infection. doi: 10.1101/2020.03.11.987958

This is a recently published article that describes in detail research into the efficacy of catalytic monoclonal antibodies as they relate to the treatment of COVID-19. The author of this publication is a heavily cited researcher involved in the study of synthetic antibodies that could be used to treat coronaviruses, specifically SARS-CoV-2.

This is another high-quality research journal at the bleeding edge of current progress. The research presented here shows that successful progress is possible in treating an individual’s immune system to possess antibodies capable of detecting and attacking the virus. A strength of using this source is that it extremely recent research that has been published by a respected academic researcher in the field of monoclonal antibodies. A potential drawback of using this source is that upon more scrutiny from peer review, the researcher’s claim could break down as events progress.