

# LABORATORY EARTHQUAKE ANALYSIS

Olga Tanyuk<sup>1</sup>, Daniel Davieau<sup>1</sup>, Dr. Michael L. Blanpied<sup>1</sup>, Dr. Charles South<sup>1</sup>  
and Dr. Daniel W. Engels<sup>1</sup>

<sup>1</sup> Southern Methodist University, Dallas TX 75205, USA

<sup>2</sup> Add Los Alamos, USGS and or Kaggle here?

**Abstract.** Earthquakes cause deaths and destruction. The technologies used in the laboratory to simulate and collect earthquake data have improved *additional facts to be added*. In his study we predict the time remaining for imminent laboratory earthquakes more accurately (*or prove our data model or technology improvement is not helping*) than a 2017 Los Alamos National Laboratory study[1]. We analyze the data for patterns using geological subject matter expertise, statistical methods and natural intuition. We design a statistical algorithm to model the patterns and predict the remaining time before a laboratory earthquake occurs. We compare predicted versus actual time remaining to determine our accuracy.

We predicted impending laboratory earthquakes with *TBD accuracy, null hypothesis, statistical results with pvalue or confidence interval and relevent scores*.

The evidence of this experiment suggests *depends on final results*

**Be careful not to accidentally plagurize. DO NOT use figures from other publications. Even if you cite it; you are getting into areas where copyright issues arise.**

## 1 INTRODUCTION

1 Paragraph Motivtion (Sets Genrerall problem domain)

In August 2017 the Los Alamos National Laboratory predicted laboratory earthquakes with 90% confidence,  $R^2 = .89$  and *additional statistical facts to be added*. [1] *"If this challenge is solved and the physics are ultimately shown to scale from the laboratory to the field, researchers will have the potential to improve earthquake hazard assessments that could save lives and billions of dollars in infrastructure"* [2]

1 Paragraph Problem Statement (Specific Problem solved by the work)

2-3 paragraphs on solution

1 Paragraph on main results (plural)

1 Paragraph on main conclusions (plural)

1 Paragraph on paper organization

Data was attained from a Kaggle Competition sponsored by the Los Alamos National Laboratory: [www.kaggle.com/c/LANL-Earthquake-Prediction](http://www.kaggle.com/c/LANL-Earthquake-Prediction). The data in this competition is the result of a laboratory simulation.

**This is another section.** We assume that  $H$  is  $(A_\infty, B_\infty)$ -subquadratic at infinity, for some constant ...

*Notes and Comments.* The first results on subharmonics were ...

## 2 TUTORIAL MATERIAL

Paper should be tutorial in nature Audience is data scientists of varying levels of knowledge. Keep newer students in mind

## 3 DATA

Must have section that defines data Use tables and figures to illustrate data attributes

## 4 METHODS AND EXPERIMENTS

Define algorithms, methods and experiments DO NOT give play by play of everything we did Dont put code in paper; if anything put in appendix. Put versions of software but nop one cares about how to use technology; just state what we did.

## 5 RESULTS

Results of experiments Use tables and graphs Use tables and graphs Use tables and graphs Don't forget explanations

## 6 ANALYSIS

Analyze results. These are NOT conclusions.

## 7 ETHICS

Discuss ethics of your problem You MUST have ethics section.

## 8 CONCLUSION

Draw conclusionS (plural, more than one conclusion- minimum of 3) This is NOT a summary section.

## References

1. Bertrand Rouet-Leduc, Claudia Hulbert, N.L.K.B.C.J.H.P.A.J.: Machine learning predicts laboratory earthquakes
2. Kaggle, R.: Lanl earthquake prediction