

# Vandy Tombs

Applied Mathematician  
Oak Ridge National Laboratory  
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(385) 335-3296

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EDUCATION **Brigham Young University**, Provo, UT  
*Master of Science*, Mathematics August 2018  
Thesis Topic: “Euclidean Domains”  
*Bachelor of Science*, Mathematics May 2017

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SOFTWARE **Computer Languages:** Python, Julia, C++, Mathematica, R, HTML, CSS, Lua  
SKILLS **Software:** Git, Vi/Vim, Emacs, QGIS, GDAL, PDAL

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AWARDS AND GRANTS Co-PI, DOE FY24 LDRD (\$175k) Sept 2023  
Co-PI, DOE FY23 LDRD (\$250k) Aug 2022  
PI, DOE FY21 LDRD (\$800k) Sept 2020

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PROFESSIONAL **Oak Ridge National Laboratory** Oak Ridge, TN  
EXPERIENCE *Applied Mathematician* June 2020 – Present

- Researched novel privacy preserving optimization techniques for medical and computer vision applications. Implemented privacy methods and machine learning models in Python and Julia.
- Led a two-year effort that extended private machine learning techniques to models trained on limited data. Developed a benchmark low-shot geographic dataset for training low-shot models with privacy integration.
- Researched and developed a model selection and evaluation process for choosing optimal machine learning algorithm. Contributed to development of Lattice which automatically labels datasets for training and understanding machine learning algorithms.
- Developed and implemented methods in Julia for modeling building population and performing sensitivity analysis on the model. Worked with software developers to produce an interface which utilized resulting simulations and sensitivity indices.

*Post Masters Research Associate* Aug 2018 – June 2020

- Researched the efficacy of applying differentiable programming and gradient based optimization techniques to a parameterized dehazing model for improving dehazing results.
- Designed a convolutional layer and used this layer in the development of a rotationally invariant convolutional neural network. Utilized group theory to research methods to develop convolutional neural networks that are invariant to other common transformations.

**Brigham Young University** Provo, UT  
*Research Assistant*, Math Department Jan 2016 – Aug 2018

- Researched (transfinitely valued) Euclidean Domains and discovered a Euclidean Domain with no multiplicative norm. I developed an algorithm that searched for admissible primes.
- Contributed to the development of several algorithms that searched for odd perfect numbers that increased the known lower bounds for candidate odd perfect numbers.

*Web Developer*, Religion Department Sept 2013 – Aug 2016  
◦ Maintained the website for the BYU Journeys project. Participated in the creation and publication of an electronic book. Traveled with project leads to historical sites to conduct expert interviews.

*Research Assistant*, Physics Department Sept 2013 – Nov 2014  
◦ Implemented Ising models of various alloys and performed Monte Carlo simulations of these models to determine candidate alloys that would decrease airplane costs. Applied chaos theory to study the sensitivity to initial conditions within various models.

**EchoStar** American Fork, UT  
Software Engineering Intern May 2016 - Dec 2016  
◦ Designed and implemented code for streaming videos online. Ported code from Lua to C++ to decrease rendering times.

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REFEREED  
PUBLICATIONS

1. Olivera Kotevska, **Vandy Tombs**, and Mike Channer. A Review of Model Inversion Attacks, Defenses, and Future Directions. [In Revision]
2. **Vandy Tombs**, Amir Sadovnik, and Edmon Begoli. What is an Adversarial AI Example? A Review of Definitions. [Submitted]
3. **Vandy Tombs**, Olivera Kotevska, and Steven Young. Privacy Amplification for Episodic Training Methods. *Proceedings of the CIKM Workshops, 2023*
4. BYU Computational Number Theory Group (including **Vandy Tombs**). Odd, spoof perfect factorizations. *Journal of Number Theory*, 234:31–47, 2021
5. Pace P. Nielsen Chris J. Conidis and **Vandy Tombs**. Transfinitely valued Euclidean domains have arbitrary indecomposable order type. *Communications in Algebra*, 47(3):1105–1113, 2019

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OTHER  
PUBLICATIONS

1. **Tombs, Vandy**. Differential Privacy is not Privacy. *ASCR Workshop on Cyber Security and Privacy for Scientific Computing Ecosystems, 2021*
2. Guojing Cong, Steven Young, **Vandy Tombs**, and Don March. Unified Privacy, Generalization, and Convergence for Large-scale Deep Learning. *ASCR Workshop on Cyber Security and Privacy for Scientific Computing Ecosystems, 2021*
3. Mike Channer, **Vandy Tombs**, Don March, Steven Young, and Olivera Kotevska. Efficient Acquisition and Annotation of Satellite Imagery for Machine Learning Applications. *DOE GIS Poster Day, 2022*

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PRESENTATIONS

**Invited Talks**

1. Experience National Security Sciences, Oak Ridge, TN July 2023
2. IAEA Workshop, Vienna, Austria Nov 2022

**Invited Panelist**

1. Experience National Security Sciences, Oak Ridge, TN July 2022
2. AI and ML for IAEA Safeguards, Virtual Mar 2022
3. The Trillion-Pixel Challenge, Virtual April 2021

**Contributed Talks**

1. **Session Chair:** AGU Fall 2022 Meeting, Chicago, IL Dec 2022
2. PAS Workshop, Atlanta, GA Oct 2022

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| 3. American Association of Geographers, New York City, NY             | Mar 2022   |
| 4. JuliaCon, Virtual  | July 2020  |
| 5. JuliaCon, Virtual  | July 2020  |
| 6. The Trillion-Pixel Challenge, Virtual                              | April 2021 |
| 7. Annual Student Research Conference, Provo, UT                      | March 2018 |
| 8. <b>Award Winner:</b> Annual Student Research Conference, Provo, UT | March 2017 |
| 9. Annual Meeting of the Four Corners Section of the APS, Orem, UT    | Oct 2014   |
| 10. Annual Student Research Conference, Provo, UT                     | March 2014 |
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TEACHING  
EXPERIENCE

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|---|-------------------|
| <b>Oak Ridge National Laboratory</b> , Oak Ridge, TN        | 2023 – Present    |
| <i>NSF Mathematical Sciences Graduate Internship Mentor</i> |                   |
| – Jimi Kim  | Summer, Fall 2023 |
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| <b>Brigham Young University</b> , Provo, UT                 | 2015-2018         |
| <i>Teaching Assistant</i>                                   |                   |
| – MATH 112: Calculus 1                                      | Winter 2018       |
| – MATH 473: Group Representation Theory                     | Winter 2018       |
| – MATH 113: Essentials of Calculus                          | Fall 2017         |
| – MATH 303: Mathematics for Engineers                       | Fall 2017         |
| – MATH 314: Calculus of Several Variables                   | Fall 2015         |