# Andrew Hard

*Curriculum Vitae*

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## Experience

2019 - Present — **Senior Software Engineer**, Google
- Researched and built first federated speech models for Assistant with TensorFlow & Python
- Managed 3 interns and 4 engineering residents on NLP and speech modeling projects
- Interviewed 100+ candidates for engineering and ML research positions

2017 - 2019 — **Software Engineer**, Google
- Published first paper describing federated learning for a production model
- Researched and developed federated natural language processing (NLP) models
- Developed multi-word prediction for Gboard with TensorFlow, C++, Python

2011 - 2016 — **Graduate Research Assistant**, *Department of Physics, University of Wisconsin*
- Discovered Higgs boson, performed first measurements of mass, couplings, and spin
- Optimized physics searches with TB-scale datasets using machine learning techniques
- Statistical expert, created new Monte Carlo method to reduce CPU usage by $1000\times$

2014 — **Graduate Teaching Assistant**, *Department of Physics, University of Wisconsin*
- Led discussions and labs on classical mechanics, electrodynamics, thermodynamics
- Designed supplemental exercises and summary notes that boosted exam performances

2010 - 2011 — **CERN Technologist**, *Enrico Fermi Institute, University of Chicago*
- Developed & maintained calibration software package using Python and MySQL

## Education

2016 — **Doctor of Philosophy** in Physics
*University of Wisconsin*, Madison WI, USA
Thesis: *Search and discovery with the resonant $\gamma\gamma$ final state at ATLAS*
Advised by Prof. Sau Lan Wu

2010 — **Bachelor of Arts** in Physics, Honors
*University of Chicago*, Chicago IL, USA
Advised by Prof. Edward Blucher

## Skills

**Scientific** — Physics, Machine Learning, NLP, Optimization, Statistics, Simulations, Speech Processing, Numerical Methods, Data Structures, High-Throughput Computing, Databases, Scientific Communication

**Programming** — C++, Python, TensorFlow, Java, Go, LaTeX, Unix/Linux shell scripting, ROOT, Matlab, SQL

**Languages** — English (native), French (basic oral and written communication), German (A1.3)

## Volunteering & Outreach

- Participated in industry panel discussions and advisory board for physicists — 2019
- Repaired bicycles at the Silicon Valley Bicycle Exchange — 2019
- Demonstrated Newtonian physics concepts for Chicago Public Library — 2016
- Discussed research & funding with U.S. lawmakers in Washington D.C. — 2014, 2015
- Created GIF visualizations of Higgs boson discovery data — 2013

## Awards

2015 — **Teaching Assistant Rookie of the Year**, *Department of Physics, University of Wisconsin*
2013, 2014 — **Lightning Round Winner**, *US LHC User's Association Annual Meeting*

## Selected Publications

*Training Keyword Spotting Models on Non-IID Data with Federated Learning*, Andrew Hard, Kurt Partridge, Cameron Nguyen, Niranjan Subrahmanya, Aishanee Shah, Pai Zhu, Ignacio Lopez Moreno, Rajiv Mathew, `https://arxiv.org/abs/2005.10406`.

*Federated learning for mobile keyboard prediction*, Andrew Hard, Kanishka Rao, Rajiv Mathews, Françoise Beaufays, Sean Augenstein, Hubert Eichner, Chloé Kiddon, Daniel Ramage, `arxiv:1811.03604`.

*Search for resonances in diphoton events at $\sqrt{s} = 13$ TeV with the ATLAS detector*, ATLAS Collaboration, J. High Energ. Phys. (2016) 2016: 1. doi:10.1007/JHEP09(2016)001, `arXiv:1606.03833 [hep-ex]`.

*Search for Higgs boson pair production in the $b\bar{b}\gamma\gamma$ final state using $pp$ collision data at $\sqrt{s} = 13$ TeV with the ATLAS detector*, ATLAS Collaboration, ATLAS-CONF-2016-004, `https://cds.cern.ch/record/2138949`.

*A search for new phenomena in events with missing $p_T$ and a Higgs boson decaying to two photons in a 13.3 fb$^{-1}$ $pp$ collision dataset at $\sqrt{s} = 13$ TeV with the ATLAS detector*, ATLAS Collaboration, ATLAS-CONF-2016-087.

*Performance of Silicon Pixel Detectors at Small Track Incidence Angles for the ATLAS Inner Tracker Upgrade*, ATLAS Collaboration, ATL-INDET-PROC-2015-011, `https://cds.cern.ch/record/2065104`.

*Search for non-pointing and delayed photons in the diphoton and missing transverse momentum final state in 8 TeV $pp$ collisions at the LHC using the ATLAS detector*, ATLAS Collaboration, Phys. Rev. D90, 112005 (2014), `arXiv:1409.5542 [hep-ex]`.

*Evidence for the spin-0 nature of the Higgs boson using ATLAS data*, ATLAS Collaboration, Phys. Lett. B726 (2013) 120, `arXiv:1307.1432 [hep-ex]`.

*Measurement of Higgs boson production in the diphoton decay channel in $pp$ collisions at center-of-mass energies of 7 and 8 TeV with the ATLAS detector*, ATLAS Collaboration, Phys. Rev. D90, 112015 (2014), `arXiv:1408.7084 [hep-ex]`.

*Observation of a new particle in the search for the Standard Model Higgs boson with the ATLAS detector at the LHC*, ATLAS Collaboration, Phys. Lett. B716 (2012) 1-29, `arXiv:1207.7214 [hep-ex]`.

Significant contributions to 20 papers & notes since 2011, author on 250+ ATLAS publications since 2013.

## Selected Conference Presentations

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|---|---|
| March 2019 | **Federated Learning for Mobile Keyboard Prediction** (Poster)<br>*13$^{th}$ Annual Machine Learning Symposium, New York Academy of Sciences*, New York, USA |
| August 2016 | **Search for the production of the Higgs boson in association with invisible particles in the ATLAS detector** (Poster)<br>*38$^{th}$ International Conference on High Energy Physics*, Chicago, USA |
| July 2016 | **Search for a high mass diphoton resonance using the ATLAS detector** (Invited talk)<br>*22$^{nd}$ International Symposium on Particles, Strings and Cosmology*, ICISE, Vietnam |
| April 2014 | **Higgs to diphoton workshop perspective** (Invited talk)<br>*ATLAS Higgs Workshop*, Rome, Italy |
| December 2013 | **Individual and combined measurements of the spin and parity properties of the Higgs boson using the ATLAS detector** (Invited talk)<br>*High Energy Physics in the LHC Era*, Valparaíso, Chile |
| August 2013 | **Spin measurement of the Higgs-like resonance observed in the two photon decay channel in ATLAS** (Talk)<br>*2013 APS Division of Particles and Fields Meeting*, SCIPP, Santa Cruz, USA |
| November 2012 | $h \to \gamma\gamma$ **vector boson fusion** (Invited talk)<br>*US ATLAS Diboson Jamboree*, Brookhaven National Laboratory, USA |

## References

**Prof. Sau Lan Wu**
*University of Wisconsin*
Contact available upon request

**Prof. John Parsons**
*Columbia University*
Contact available upon request

**Dr. Tancredi Carli**
*CERN*
Contact available upon request