Kevin Nash

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Research Associate with ten years of experience performing data analyses during both doctoral and post-doctoral physics research. Applied advanced analysis techniques to extract features that typically exist at the part-per-billion level. Applied machine learning to analyses resulting in a feature extraction sensitivity of a factor of ten over the current state-of-the-art methods. Published multiple data analyses in peer-reviewed journals including feature exclusion, calibration of feature extraction techniques, and machine learning. Four years of experience managing analysis groups to produce both published results for journals, and algorithms for the larger collaboration.

# Education

**Johns Hopkins University, Baltimore MD:** ***Physics, Ph.D. 2015, M.A. 2012***
- Performed searches for rare features of the dataset by deploying new pattern based discriminators[1].
- Precision background modeling and uncertainty estimation.

**James Madison University, Harrisonburg VA:** ***Physics, B.S. 2009***

# Experience

**Rutgers University, Piscataway NJ:** ***Post-doctoral Associate, Research Associate (2015–Present)***
- Both led and contributed to multiple full data analyses, resulting in 7 results[2] published in peer-reviewed journals.
- On the forefront of applying modern machine learning to physics analyses. Developed the $\mathrm{Image}_{\mathrm{Top}}$ discriminator, a CNN which uses correlated detector inputs as an analogue of pixel intensity and color. This resulted in a factor of ten in sensitivity over conventional methods[3].
- Deployed the $\mathrm{Image}_{\mathrm{Top}}$ discriminator, which includes uncertainty calibration and integration into the larger software framework – allowing it to be used in data analyses and simulations.
- Converted the $\mathrm{Image}_{\mathrm{Top}}$ network into both GAN- and Autoencoder-based anomaly detection networks for extracting unknown features from data.
- Created generic background estimation methods based on an extrapolation from signal-poor control regions.
- Presented at multiple major conferences.

**Subgroup Manager (2017–2021)**
- Managed ∼30 doctoral students and researchers corresponding to ∼7 simultaneous research groups.
- Coordinated the deployment of deliverables within strict deadlines.
- Conducted peer-review of multiple projects prior to allowing mature analyses to proceed to the journal review.

[1] Published (JHEP): *JHEP 02 2016 122*, *JHEP 01 2016 166*
[2] Selected Publications: *JHEP 03 2019 127*, *JINST 06 2020 P06005*, *HEP-EX:2104.12853*, *JHEP 08 2017 029*
[3] Published (JINST): *JINST 06 2020 P06005*

# Hard Skills

**Python - 10 years**
- Designing full data analysis frameworks to perform feature extraction of large datasets.
- Experienced in NumPy, Pandas, Jupyter, Scipy, Scikit-learn, Anaconda, Matplotlib, multiprocessing, etc.

**C++ - 10 years**
- Contributing to large collaborative analysis pipelines.

**Machine learning - 5 years**
- Implementing neural network object recognition for scientific research.
- Both prototyping new models and optimizing existing models.
- Performing studies of architecture design, input preprocessing steps, and hyperparameter optimization scans.
- Using Keras, TensorFlow, PyTorch.
- Implementing CNNs, Autoencoders, MAFs, and GANs for deployed projects.
- Experience creating custom LSTMs and GCNs.
- Designing machine learning workstations, awarded the Nvidia GPU grant for fundamental scientific research.
- Interfacing with single and multi-GPU models.

**SQL - 2 years**
- Using MySQL to create an automated database of sensors and corresponding calibrations.

**Code management and optimization**
- Using Github, Gitlab, SVN, and CVS version control software for collaboration.
- Using Condor and LSF to access large CPU clusters.
- Efficiency optimization, such as converting to vectorized functions, preprocessing/skimming, and parallelization.
- Sensitivity optimization, such as maximizing feature significance and minimizing systematic uncertainties.

**Statistical Analysis**
- Fitting of data, including histogram morphing and curve fitting using both parametric and non-parametric methods.
- Estimation of systematic uncertainties and error propagation.

# Soft Skills

**Public Speaking**
- Periodic updates of ongoing data analyses to the larger community.
- Presenting at large public conferences around the world, experience converting technical results for the public.

**Managerial**
- Four years managing data analysis groups and coordinating a publication strategy.

**Language Editing**
- A Certified Language Editor in charge of the final textual review for papers submitted to the journal.