# David Montague

Passionate about machine learning, augmented reality, and outcome-driven development

## Experience

**Exactrics, Inc.** • Founder & CTO • Jul 2018 – Dec 2019

*Exactrics lets you scan clothes with your phone, then search, filter, and compare by fit while shopping online*

* Built a pipeline for converting sets of smartphone photos into millimeter-precision clothing scans
* Built custom fit-search, look-search, and fit-comparison engines for use with our scan data
* Built and maintained our backend server and cloud deployment infrastructure
* Collaborated on the frontend, including development of client SDKs and custom data visualizations

**Palantir Technologies** • Member of the Technical Staff • Oct 2015 – Feb 2018

* Adapted modern math, stats, and CS techniques to build solutions for Palantir’s most critical customers and product teams. Selected projects include:
  + A personalized document feed used by intelligence analysts to surface urgent new reports
  + A viewership model used by a TV network to simulate and optimize promotional campaigns
  + A customer churn model used by a major payment processor to prioritize CRM efforts

## Education

* **Stanford University** • PhD, Mathematics • MS, Statistics • 2012 – 2017
  + Thesis: [Covariance estimation and graphical models for infinite collections of random variables](https://searchworks.stanford.edu/view/11891187)
* **Cambridge University** • MASt, Mathematics • Churchill Scholarship • 2011 – 2012
* **University of Michigan – Ann Arbor** • BS, Mathematics • 2007 – 2011

## Selected Projects

**Clothing Fit Scan Pipeline (Exactrics)**

* Reconstructed multiple surface views with traditional photogrammetry techniques
* Used output masks from CV models to stitch reconstructions into clothing item surface
  + Used a custom U-Net to precisely segment clothing from background in each view
  + Handled non-rigid deformations with a Siamese CNN to identify surface correspondences
* Computed geodesic-based clothing surface vectorizations for fit-based search and recommendation

**Intelligence Document Recommendation Engine (Palantir)**

* Vectorized documents using various domain-specific features:
  + Custom word vectors built from domain corpus
  + Sparse named entity features (using domain-specific NER refinements)
  + Geographic features from a hidden layer of an auxiliary network with lat/lon inputs
* Combined document vectors with user interaction data to build user profile vectors
* Recommended new documents by predicting interaction from (user, document) vector pairs

## Skills

**Machine Learning and Data Science**

* Have deployed models in numerous domains:
  + TV advertising, drug discovery, fraud detection, remote sensing, O&G predictive maintenance, etc.
* Experienced with various forms of unstructured data: images, audio, time-series, text, etc.
* Experienced writing data processing pipelines of various complexities and sizes (up to terabyte-scale)
* Experienced with out-of-core techniques for “big” data, and optimal inference techniques for “small” data

**Computer Vision and Augmented Reality**

* Have used CNNs, U-Nets, and custom neural nets to automate various image-processing tasks
* Extensive experience using scikit-image and OpenCV for 2D image pre-processing and manipulation
* Have used OpenCV, Open3D, AliceVision, CGAL, etc., to solve various 3D mesh geometry problems
* Experienced working with raw RGB-D data from Intel RealSense cameras and dual-camera phones
* Understand the capabilities and limitations of the high-level mobile AR toolkits (ARKit and ARCore)

**High-Performance Python**

* Deeply familiar with scientific python, including numpy, scipy, matplotlib, pandas, scikit-learn, etc.
* Experienced using Cython and C++/PyBind11 to write various high-performance extensions
* Experienced orchestrating streaming processing jobs on non-server nodes with celery
* Experienced using Apache Spark to perform large-scale analytics jobs on a dedicated cluster

**Web APIs, Frontend, and DevOps**

* Experienced designing, developing, and deploying APIs for web and mobile front-ends
* Extensive experience with python’s ASGI server ecosystem
  + Have contributed to pydantic, fastapi, starlette, and more
* Experienced with frontend frameworks: React and Vue on the web; UIKit and SwiftUI on iOS
* Familiar with typical infrastructure requirements and security concerns for public-facing web services
* Experienced using Docker to develop and deploy containerized web services to multiple cloud providers

**Agile Development**

* At Palantir, used scrum to establish a reputation of consistently delivering high-quality results on time
* Understand the importance of communication; high-frequency iteration with stakeholders is a top priority
* Methodical about formulating, testing, and confirming/rejecting business hypotheses

## Articles and Publications

* Machine Learning
  + [Algorithmic Trading of Futures via Machine Learning](http://cs229.stanford.edu/proj2014/David%20Montague,%20Algorithmic%20Trading%20of%20Futures%20via%20Machine%20Learning.pdf) (Stanford CS229 Project)
* Math
  + [Graphical Markov Models for Infinitely Many Variables](https://arxiv.org/pdf/1501.07878.pdf)
  + [5 other mathematics papers](https://arxiv.org/search/?query=%22David+Montague%22&searchtype=all&abstracts=show&order=-announced_date_first&size=50)

## [Open Source Projects](https://github.com/dmontagu)

* [**FastAPI**](https://fastapi.tiangolo.com/) • [*Collaborator on GitHub*](https://github.com/tiangolo/fastapi)
* [**Pydantic**](https://pydantic-docs.helpmanual.io/) • [*Collaborator on GitHub*](https://github.com/samuelcolvin/pydantic)
* [**FastAPI Utils**](https://fastapi-utils.davidmontague.xyz) • [*Owner on GitHub*](https://github.com/dmontagu/fastapi-utils)
* [**FastAPI Client**](https://github.com/dmontagu/fastapi_client) • [*Owner on GitHub*](https://github.com/dmontagu/fastapi_client)
* [**setuptools-cpp**](https://setuptools-cpp.davidmontague.xyz) • [*Owner on GitHub*](https://github.com/dmontagu/setuptools-cpp)

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