Sebastian **Bernasek**

Data Scientist | Chemical Engineer

San Francisco Bay Area

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Summary

Chemical engineer turned data scientist with 5 years computational biology research and 3 years work experience as a process design engineer.

Skills

Data Engineering
Relational databases
Web scraping
Structured text & NLP
Feature selection
Dimensionality reduction

Analysis
Hypothesis testing
Bayesian inference
Unsupervised learning
Networks & Time series
Visualization

Computer Vision
Feature extraction
Image segmentation
Feature classification
Spatial analysis
Quantitative microscopy

Modeling
Stochastic processes
Dynamical systems
Nonlinear regression
Classification
Agent-based models

Coding
Python & Cython
Package development
REST APIs
Git, LaTeX, HTML/CSS
Unix shell, OSX/Ubuntu

Education

Ph.D. in Chemical and Biological Engineering • 4.0 *Northwestern University* 2014 - 2019

- Advised by Luis Amaral, Neda Bagheri, and Rich Carthew.
- Center Scholar, NSF-Simons Center for Quantitative Biology
- Dissertation combined data science and chemical engineering to explore how cells make reliable decisions.

B.S. in Chemical Engineering • 3.8 • High Honors *University of California, Santa Barbara* 2008 - 2012

- Exchange student at Imperial College London throughout 2010/2011.

Experience

Personal Development & Consulting Present

Took a year off to explore the world, while assisting some friends along the way:

- Built a database of 5k+ targeted B2B sales leads using a combination of web-scraping, commercial APIs, and machine learning.
- Demystified a sales pipeline by using unstructured text profiles to predict client outcomes.
- Automated text content extraction and parsing routines that will annually save hundreds of hours of tedious labor.

Researcher at Northwestern University *Evanston, IL* 2014 - 2019

- Published in high profile journals including Cell and PLOS Computational Biology.
- Designed, built, and deployed several simulation and analysis frameworks for the broader research community.
- Discovered a surprising link between expression dynamics and metabolism by developing a model that accurately predicts developmental mistakes.
- Discovered a novel cell decision mechanism by using computer vision and statistical analysis to derive insight from microscopy data.
- Increased data volume and quality by developing a computer vision pipeline for automated analysis of microscope images.

Day to day life entailed:

- Exploratory analysis and visualization of image and time series data.
- Developing creative strategies to tease insight out of noisy experiments.
- Building mathematical models to generate testable predictions.
- Conducting tens of thousands of parallel simulations on a distributed computing cluster.
- Frequent collaboration with wet labs to design more impactful experiments.
- Brainstorming & hackathons for data-driven projects of all flavors, from painting styles to political tweets.
- Communicating complex ideas to diverse audiences.
- Academic reading, writing, peer review, and grant proposals.
- Co-teaching undergraduate chemical engineering courses and data science bootcamps.
- Mentoring graduate, undergraduate, and high school students in formulating their own research.

Process Engineer at LanzaTech *Chicago, IL* 2012 - 2014

- Invented three processes for converting waste gases to lipid products. One patent granted, two more applications pending.
- Designed and built the company's core process modeling framework.
- Identified promising technology partners, ultimately leading to major investments.
- Modeled refinery-scale processes to predict and optimize economic and life-cycle performance.
- Advised executives and investors with technical analysis.

Projects and software are detailed on my website. References available upon request.

Research Assistant at UC Santa Barbara *Santa Barbara, CA* 2011 - 2012

- Conducted first ever dynamic measurement of interaction forces between vesicles. Published in *Soft Matter*

Summer Intern at UL Air Quality Sciences *Atlanta, GA* Summer 2011

Publications

Ratio-based sensing of two transcription factors regulates the transit to differentiation. *Under Revision*

*Sebastian Bernasek**, J.F. Lachance*, N. Peláez*, R. Bakker, H. Navarro, L. Amaral, N. Bagheri, I. Rebay, R. Carthew *Expected 2020*

Fly-QMA: Automated analysis of mosaic imaginal discs in Drosophila. Published in *PLOS Comp. Biology*

Sebastian Bernasek, N. Peláez, R. Carthew, N. Bagheri, L. Amaral *2020*

Repressive gene regulation synchronizes neural development with cellular metabolism. Published in *Cell*

J. Cassidy*, *Sebastian Bernasek**, R. Bakker, R. Giri, N. Peláez, B. Eder, A. Bobrowska, N. Bagheri, L. Amaral, R. Carthew *2019*

Quantitative analysis of cell fate decisions. Doctoral Dissertation

Sebastian Bernasek *2019*

Direct measurement of interaction forces between charged multilamellar vesicles. Published in *Soft Matter*

J. Frostad, M. Seth, *Sebastian Bernasek*, L.G. Leal *2014*

Patents

US Patent App. 62/872,869, Methods for Optimizing Gas Utilization. LanzaTech

Sebastian Bernasek & Co-inventors *Filed 2019*

US Patent App. 14/927,950, Fermentation process for the production of lipids. LanzaTech

Sean Simpson and *Sebastian Bernasek* *Filed 2014*

US Patent 9,783,835, Method for producing a lipid in a fermentation process. LanzaTech

Sean Simpson and *Sebastian Bernasek* *Granted 2017*

Software

FlyQMA On PyPI

Python package for automated mosaic analysis of *Drosophila* imaginal discs. Facilitates high-throughput segmentation, bleedthrough correction, and annotation of raw microscope images in order to accelerate experimental pipelines while improving reproducibility.

FlyEye Analysis On PyPI

Python platform for analyzing gene expression dynamics in the developing fly eye. Ascribes quantitative rigor to a popular experimental technique by supporting dynamic analysis, spatial analysis, model fitting, and visualization of the resultant trends.

TFBinding On GitHub

Python package for simulating the statistical mechanics of cooperative binding events between transcription factors and their target promoters. Leverages a novel and highly-parallelizable microstate enumeration algorithm to dramatically outperform the existing state of the art in terms of both memory footprint and simulation scale.

GeneSSA On GitHub

A python framework for exact stochastic simulation of Markov processes, with a particular emphasis on gene regulatory networks. Simulates many classes of large networks faster and more efficiently than all other available software.

Mentorship

Simran Khunger *High school student* Summer 2017

Project: Designing synthetic benchmarks for 3D segmentation of cell membranes in the larval *Drosophila* eye.

Darshan Patel *Chemical engineering undergraduate* Summer 2016

Project: Probing tradeoffs between efficiency and robustness via in silico evolution of GRN topologies.

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Teaching

Chemical Engineering Methods and Analysis Spring 2018

Reaction Engineering and Kinetics Spring 2017

Process Engineering and Design Spring 2016

Data Science Bootcamp Summer 2015

Reaction Engineering and Kinetics Spring 2015