Artificial Intelligence for Craft Cannabis Products

Dr. Markus Roggen
President/CSO
Delic Labs

Welcome back to 2020

- COVID Pandemic
- Russia invades Ukraine
- We don’t know who wins the 2020 presidential election
- San Diego is sunny and warm in February
- Markus talks about cannabis extraction

Welcome to 2022

- CBDV is now Delic Labs
- Markus lost his job at CEO, now CSO
- Extraction becomes ∞eta
  - Big Data Approach to Extraction
  - Input Problems
  - Training the AI
  - Going beyond Average Cannabis
  - Guiding Craftsmanship

About Us

Health Canada License for Cannabis and Psychedelic Research
Clients: MSOs, LPs, Tobacco, Chemical
Experience:

- Data Science
- Process Chemistry
- Analytical Chemistry
- Computational Medicinal Chemistry

Based in Vancouver, at UBC Campus
Diverse and Bright Scientists work here

DELIC LABS

Big Data in Cannabis

Data Analytics is utilized in Cannabis Industry

- Inventory Management
- Grow Processes
- Sales Analytics
- Customer Analytics
- Locality Programs

New Frontier data

Cannabis Big Data

HEADSET

BDSA

TRYM™

mj freeway®

Forbes: How big data and ai help drive the cannabis industry

The Problem with Extraction

Extraction is an Art!

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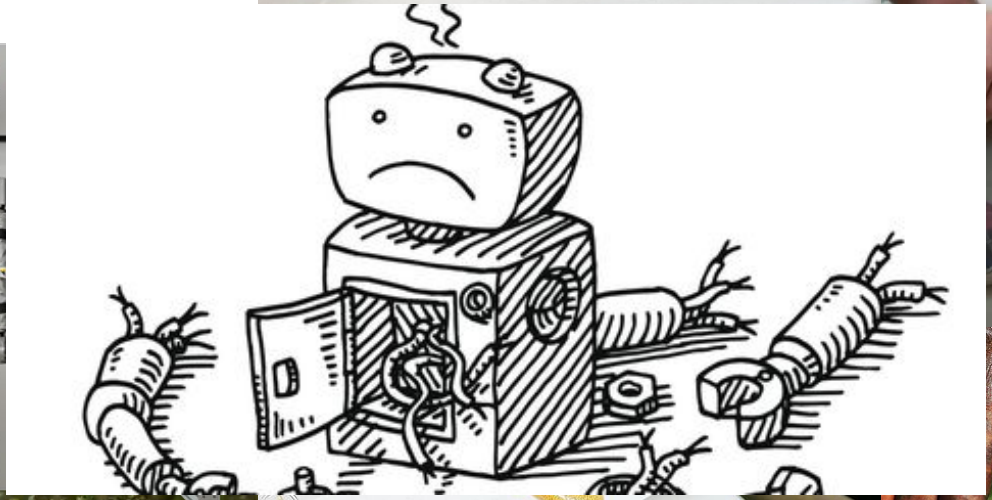
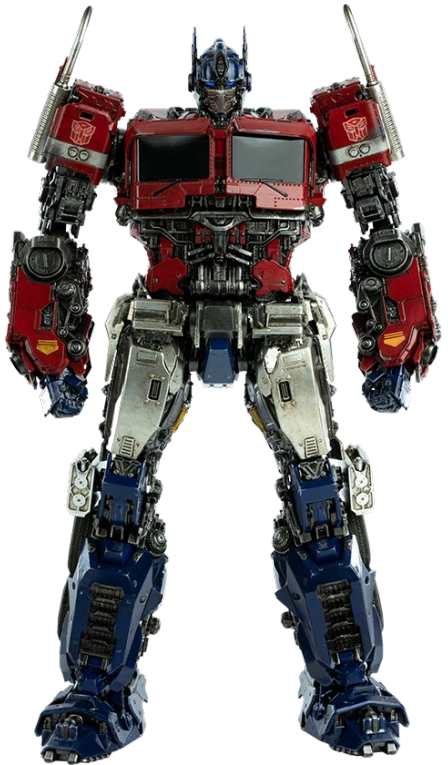


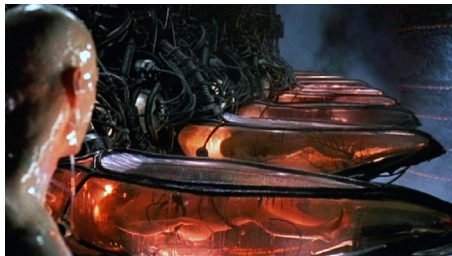
Here is the Extraction Optimus Prime

- Highest Extraction Efficiency
- Fastest Extraction Speed
- Lowest Solvent Use
- Bespoke Parameters for each Cultivar
- Unique Parameters for each Product
- Absolute Purity of Product
- No Post-Processing
- Simple and Reliable



Feed the Matrix

- Data is not Free
- Why are you collecting data?
- What questions are you trying to answer?
- Are you going to use that data?
- Does data collection change the process?
- Collecting data costs money!
- Just about anything is better than collecting data and not using it!



Dr. T. Dupree, Data Doesn't Have to Hurt, Extraction Magazine, Oct. 2021

Data is Meaningless

- Data is Worthless
- Information is Power
- Data -> Information
  - Processing
  - Organising
  - Analysing
- Focus on the data you need
- Iterate!

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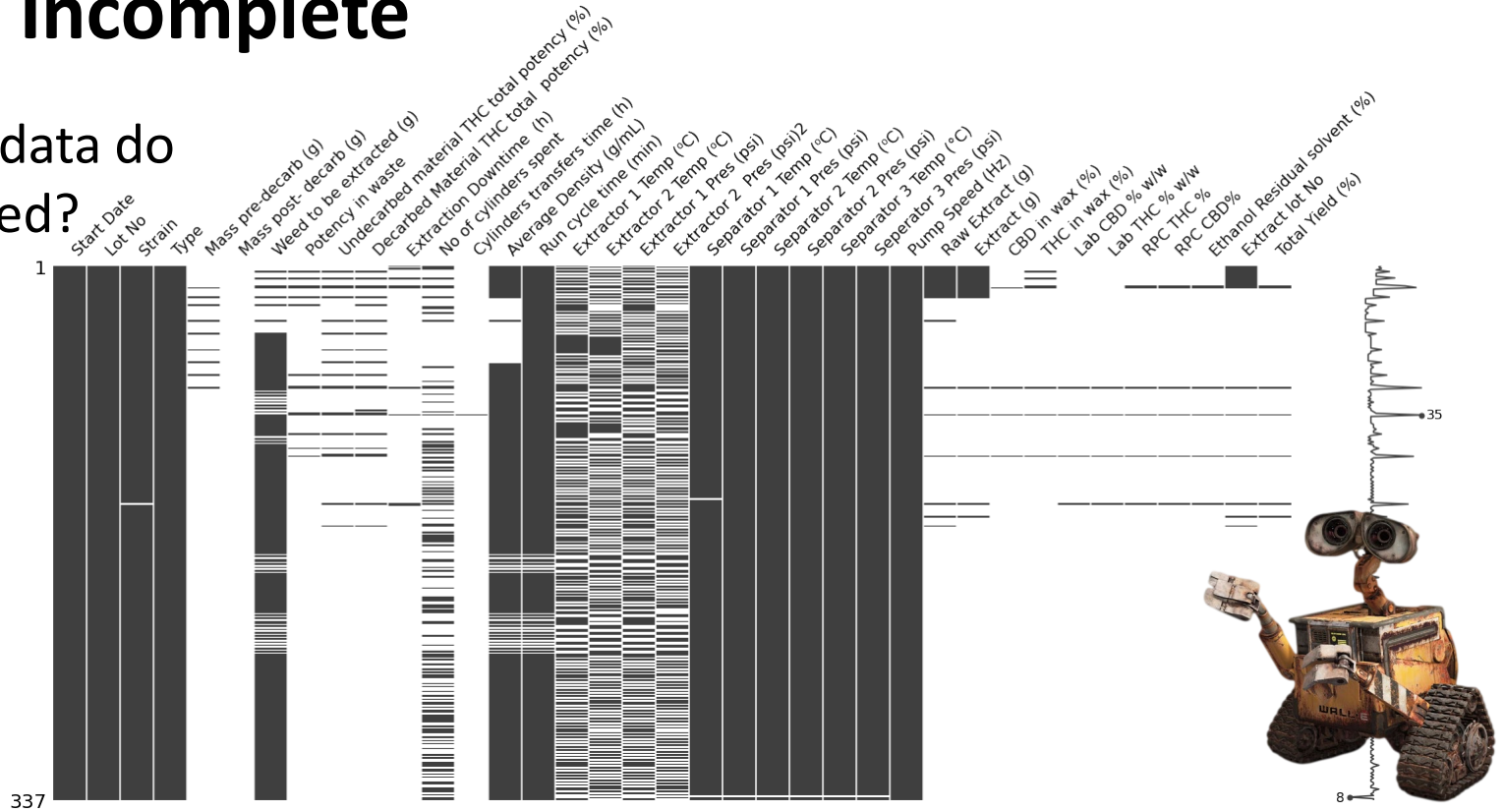
Data is Incomplete

- Which data do you need?



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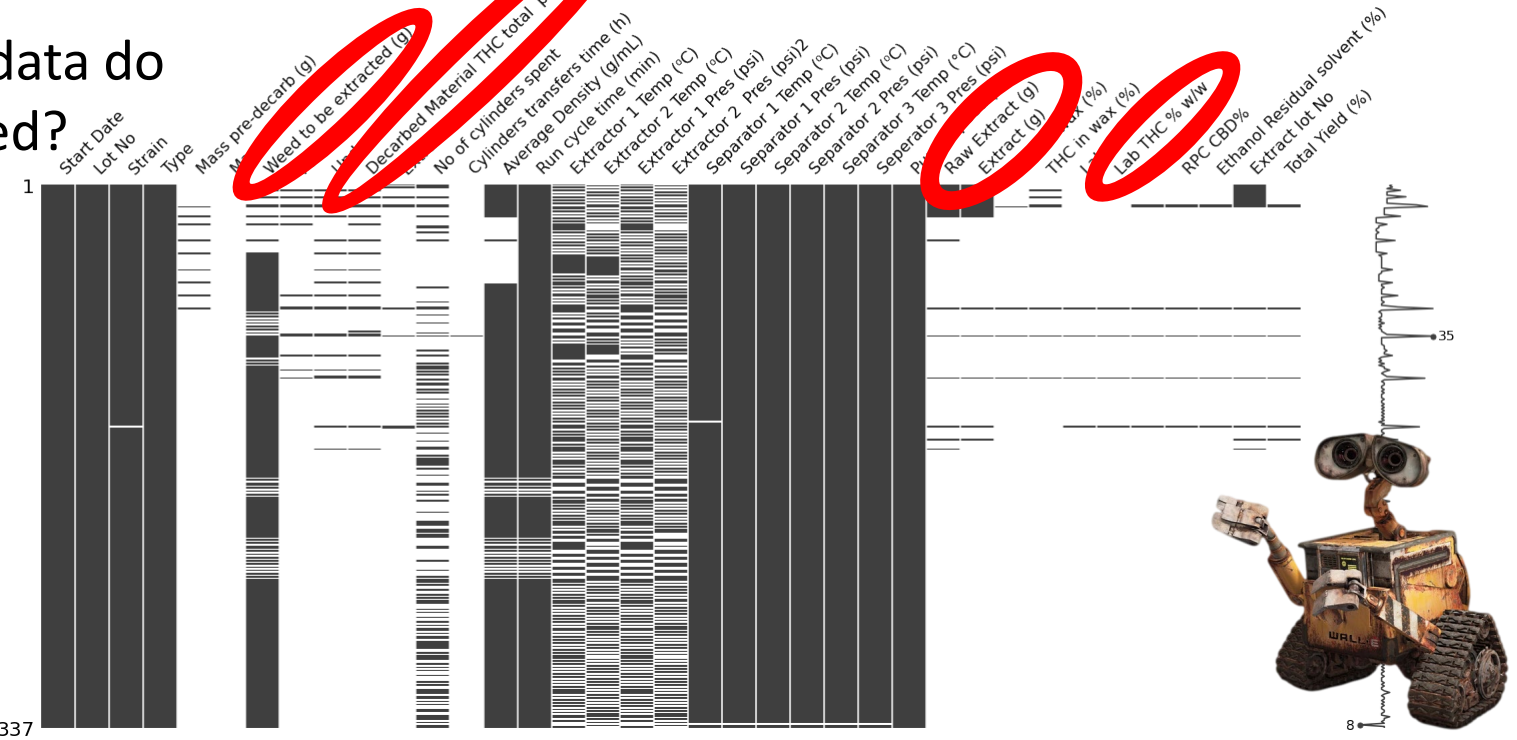

Making Sense of Data

- AI Training starts with Data
- Require High-Quality, Well-Annotated Data
- Discover patterns
- Modify and Adjust to more Data

Making Sense of Data

- Single Factor Optimization – One thing at a time
- Classic Design of Experiment – Factorial design
- OLS Linear Optimization of vast data set
- Gaussian Process – Bayesian Optimizer

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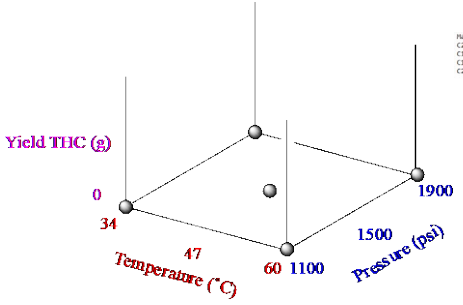

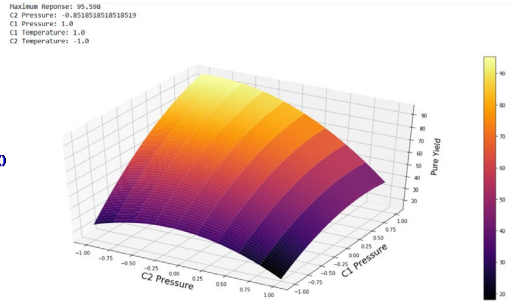

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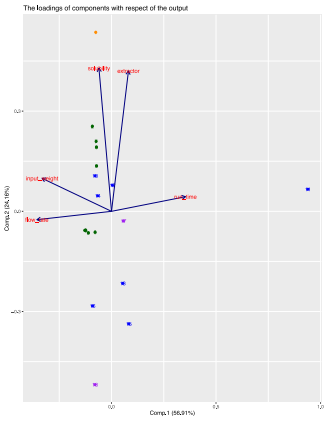
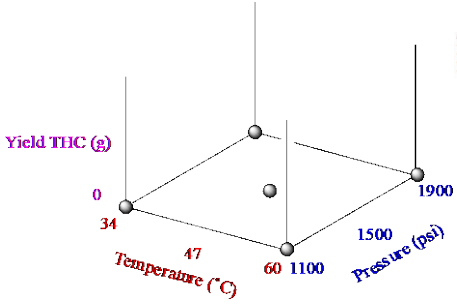
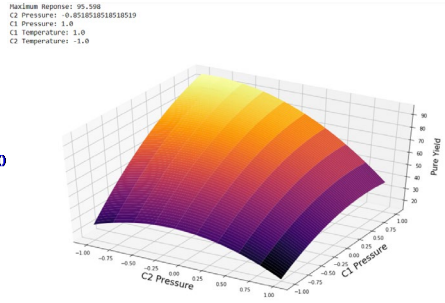
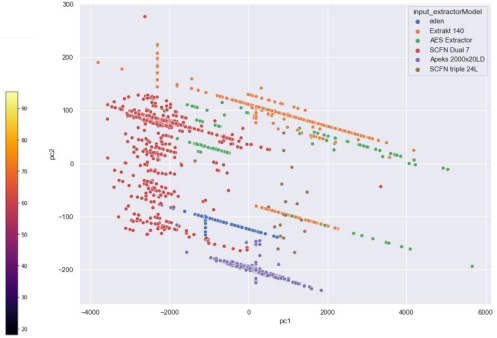




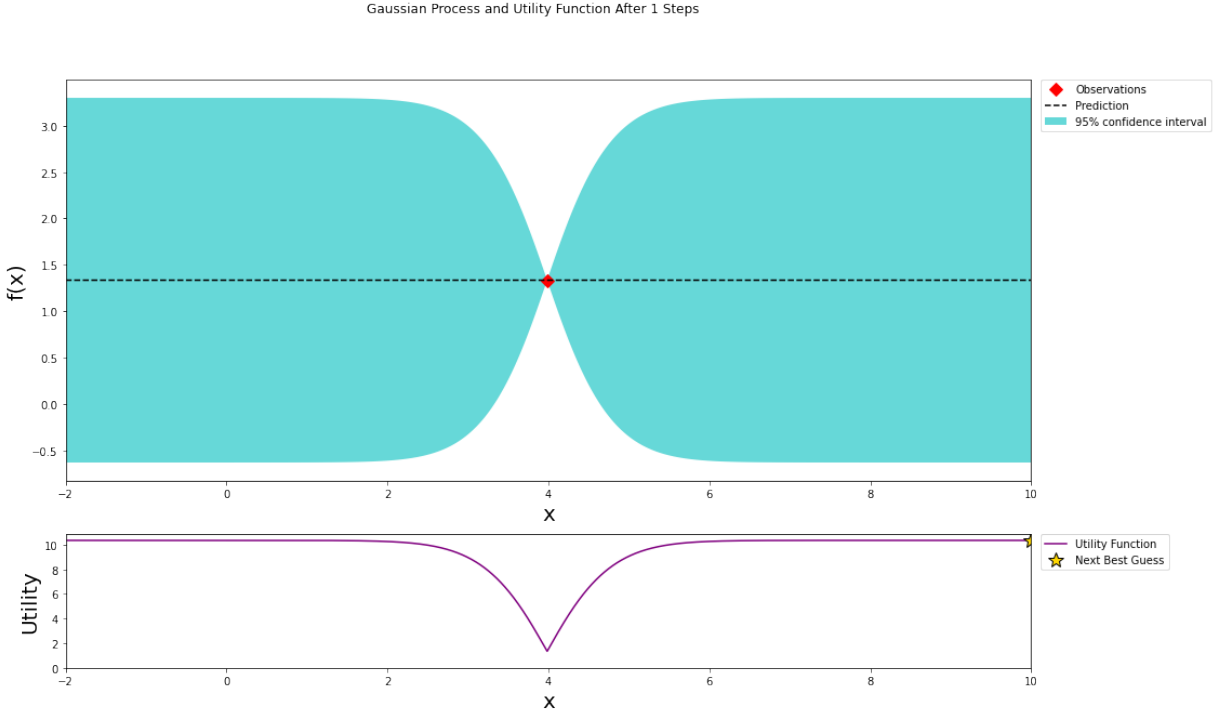




Meet Gaussian & Bayesian

Gaussian Process:

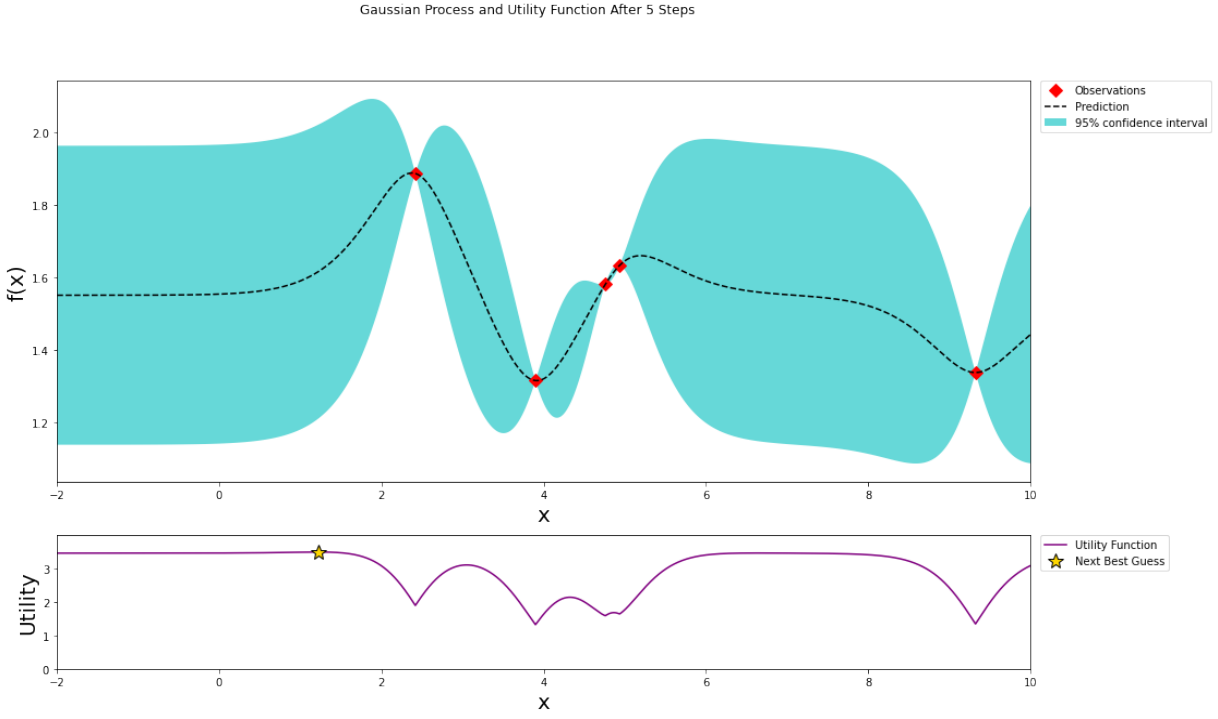
- Infinite Number of Functions
- Assign Probability to each Functions



Meet Gaussian & Bayesian

Bayesian Optimization

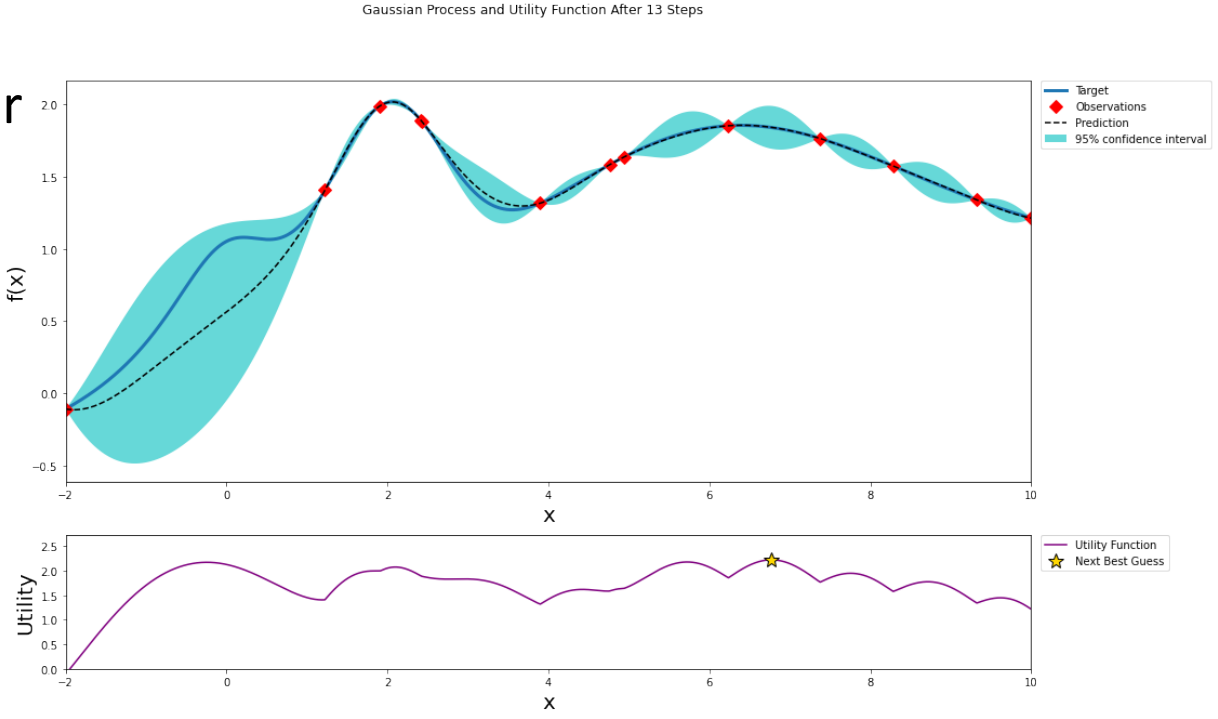
- Next best point to sample based on uncertainty and function value



Meet Gaussian & Bayesian

Bayesian Optimization

- Model requires fewer Development Runs
- New Data
  -> More Accurate



Beyond Average Cannabis

Extraction conditions for average cannabis are easy

- Temp: ~60 ^{o}C
- Pressure: ~250 Bar
- Flow Rate ~16 kg CO_2 per kg of feed / hour
- Time: ~36 kg of CO_2 per kg of feed to give ~90% recovery

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Average Cannabis:

- THC: 7.4% / THCA: 3.2%
- CBD: 1.6% / CBDA: 2.5%
- Total cannabinoids: 13.7%
- Total terpenes: 0.3% / Water content: 9.1%

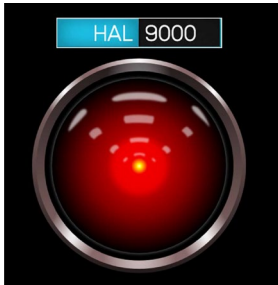
Craft Cannabis of the Future

Optimize for Batch-to-Batch Variation

- Cannabinoid Content & Profile
- Terpene, Water Content, …

Optimize for Specific Product

- Product Type (Vape Oil, Sauce, Tincture, …)
- Post Processing
- Production Costs
- Economics



Craft Cannabis of the Future

Real Life Example

- 300 bar
- 55 Celsius
- 2.5 hours @ maximum flow rate
- ~90% recovery @ ~70% cannabinoid content

Craft Cannabis of the Future

Previously

- 300 bar
- 55 Celsius
- 2.5 hours @ maximum flow rate
- ~90% recovery @ ~70% cannabinoid content

After modeling

- 75% reduction in solvent use (equipment wear and tear)
- 40% reduction in extraction time
- ~90% recovery @ ~70% cannabinoid content

Partnership

- Build Accurate Models for all Extraction Systems
- Optimize Cost, Feedstock, Product
- Automatically run Model in Background
- Gather more Datapoints with every Run
- Collaboration, Education, Specialization

Thank You!

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