AUM Experimentation Results & GDC'23

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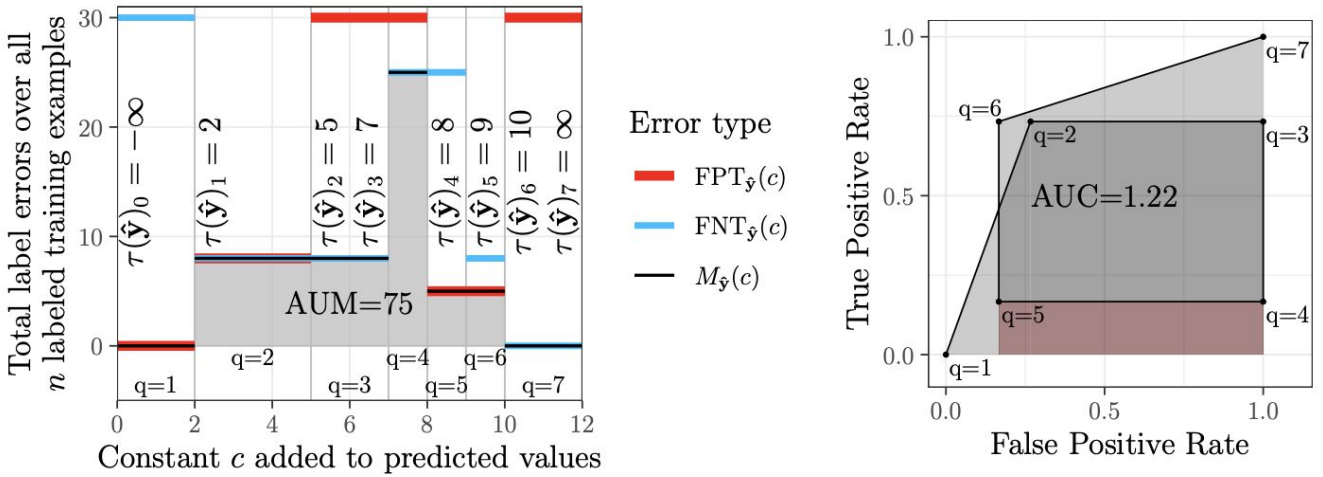
with Dr. Toby Dylan Hocking

Recap: Area Under the Minimum(FP, FN)

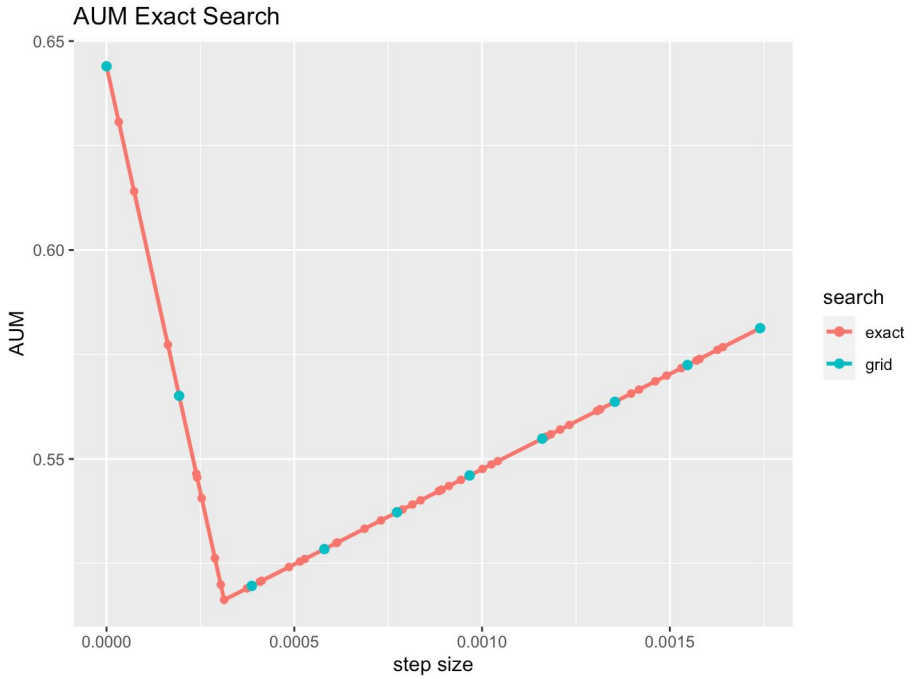
- Differentiable surrogate loss function for AUC that optimizes the individual ROC points
- Performing gradient descent with binary classification & change point detection datasets
- We have built a line search algorithm to find a step size for each iteration of gradient descent

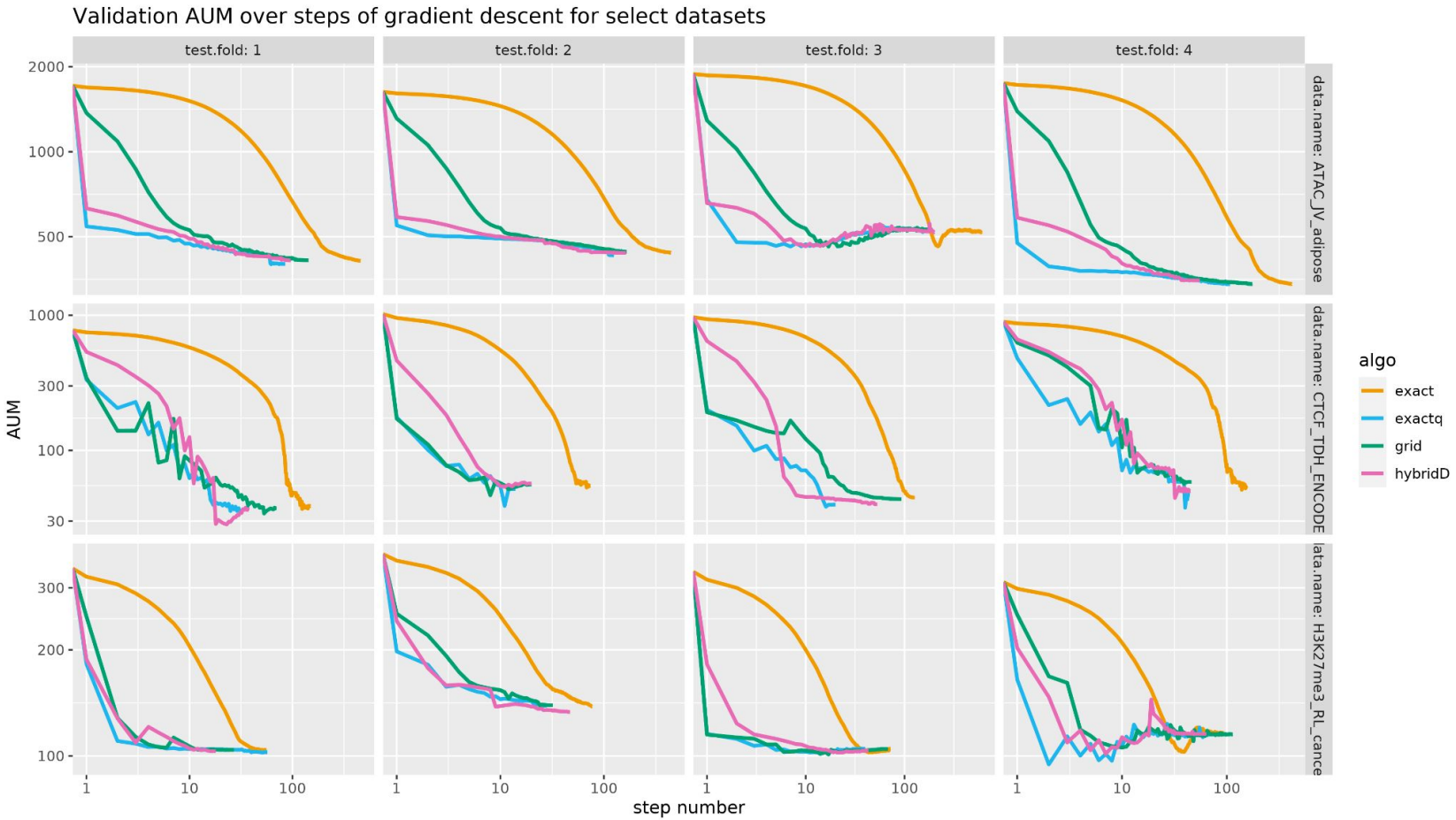


Hillman & Hocking 2021

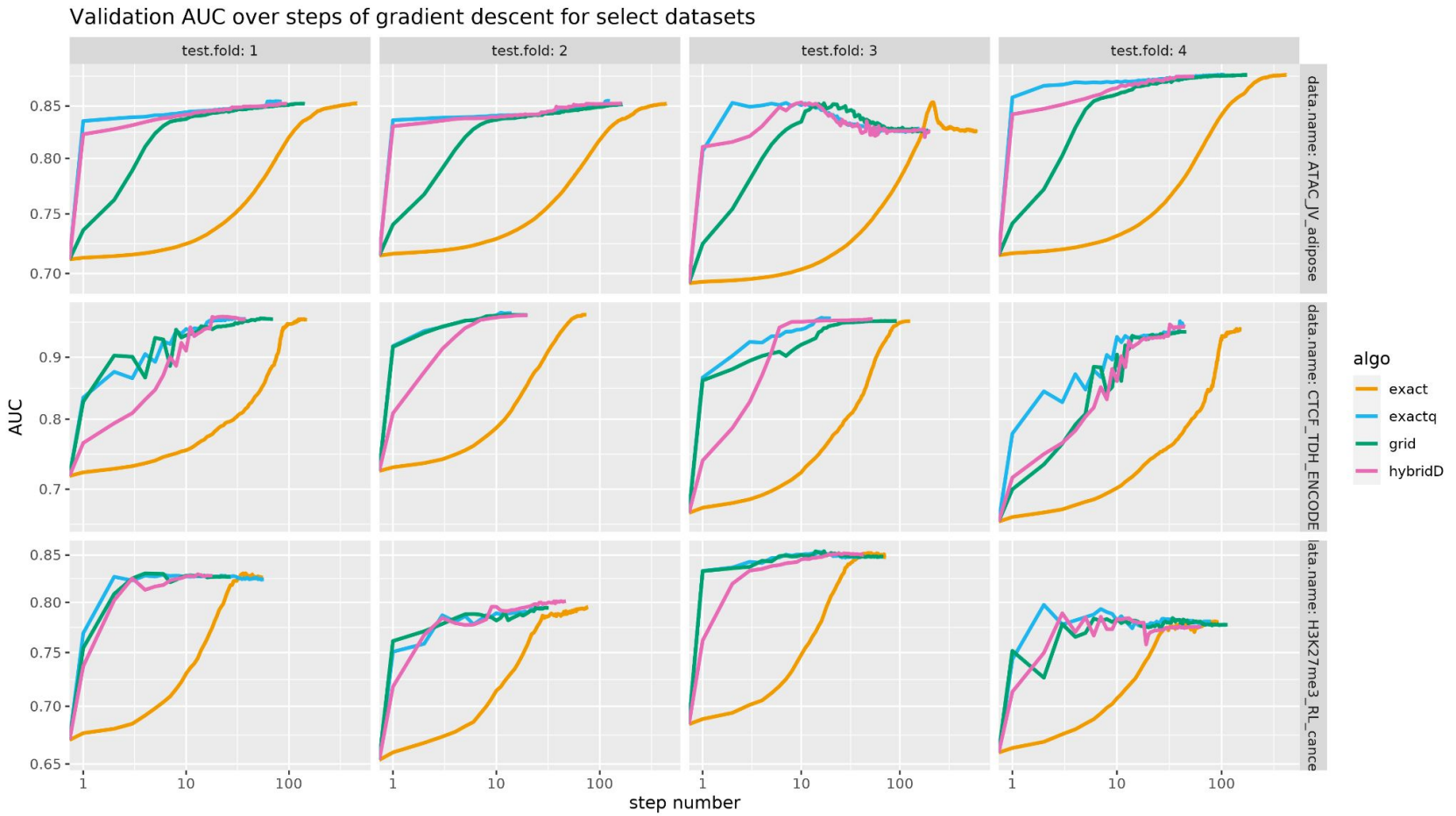
Evaluation of Line Searches

- **`grid`**: search a grid of points
- **`exactq`**: run the exact search for the entire search space (quadratic)
- **`exact`**: only check N points
- **`hybrid`**: run exact line search. if the best point was the *last* point we check, check a grid of larger step sizes

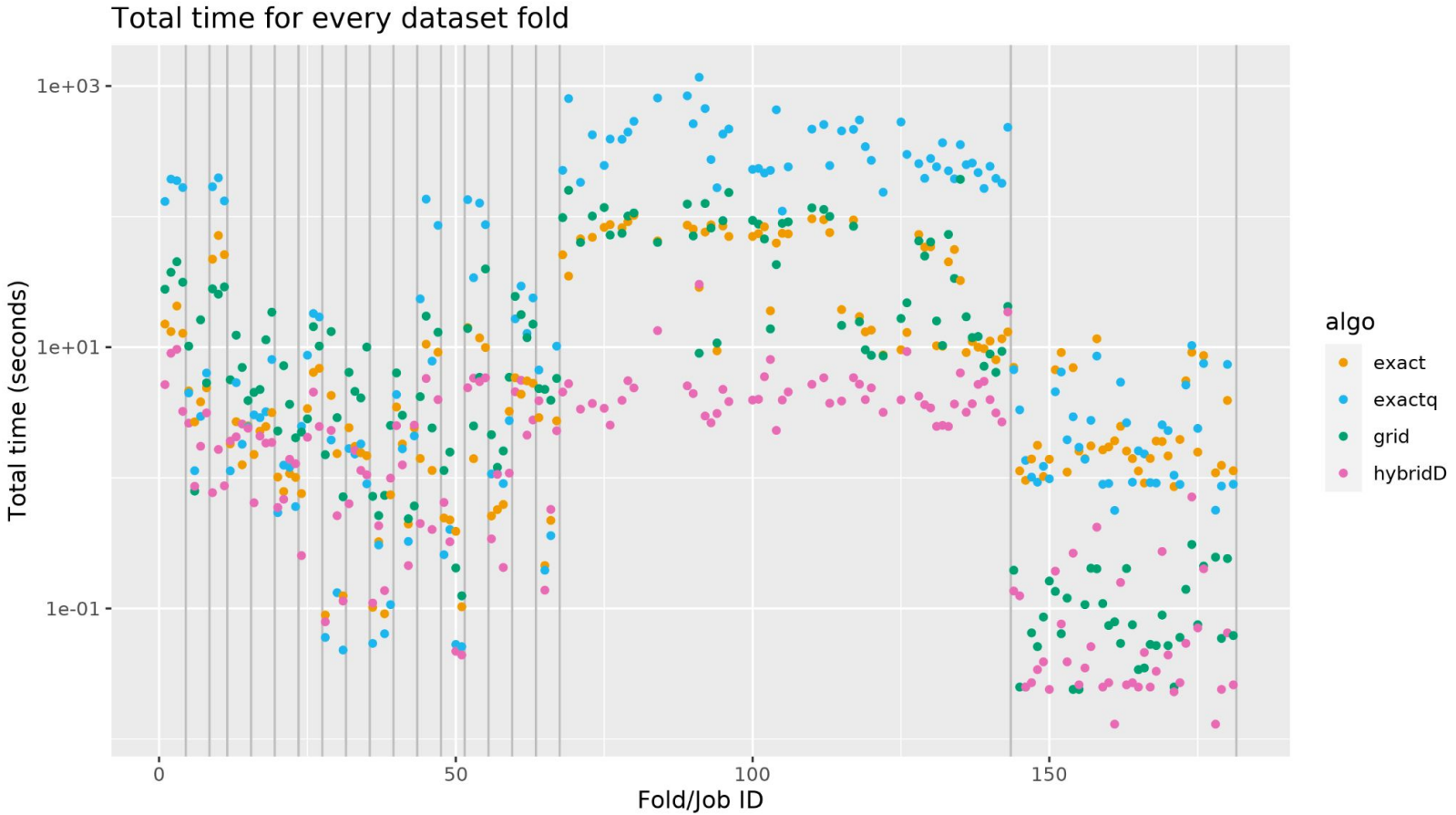




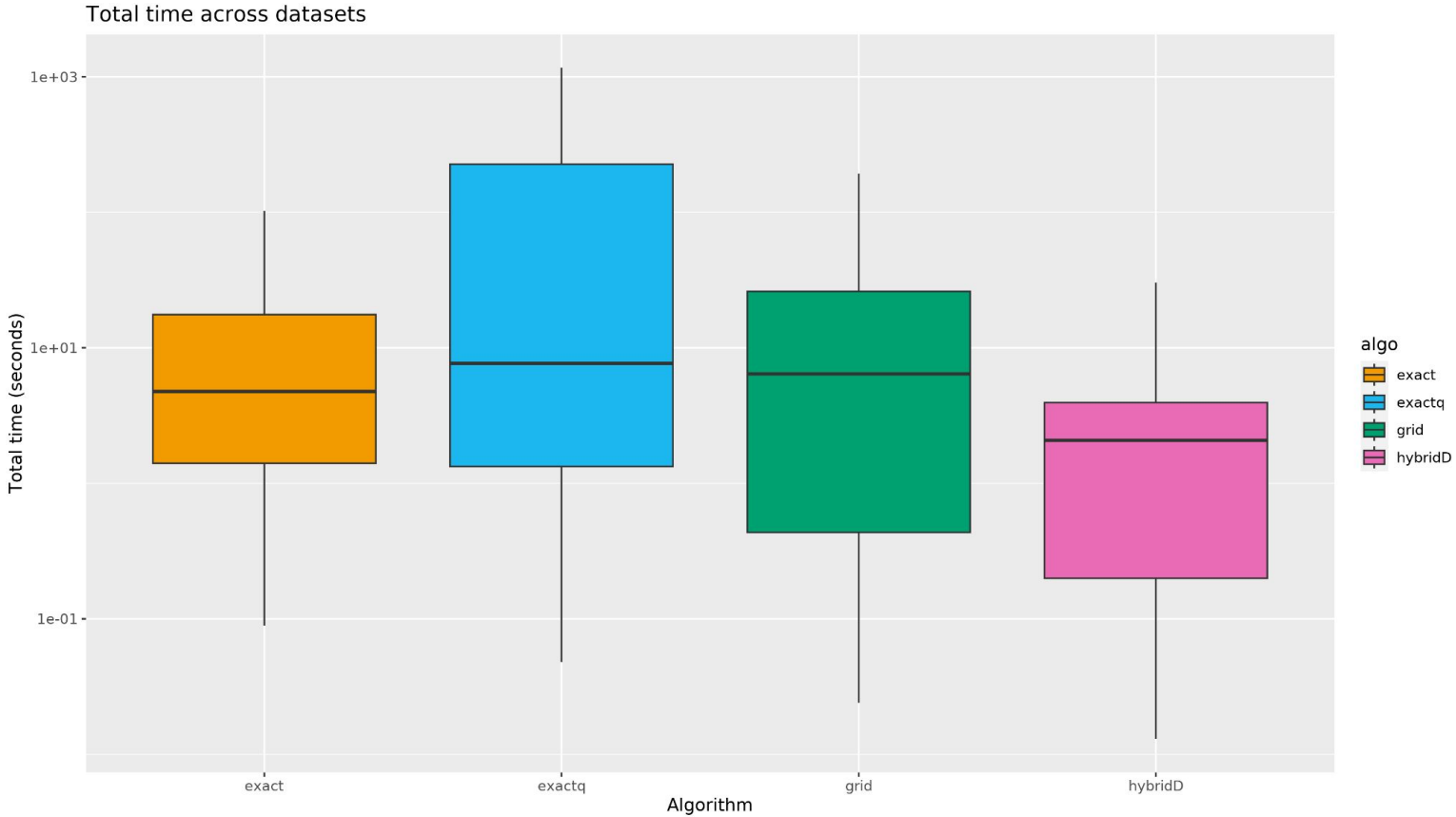
Hybrid is decreasing as fast as Exactq while checking less points.



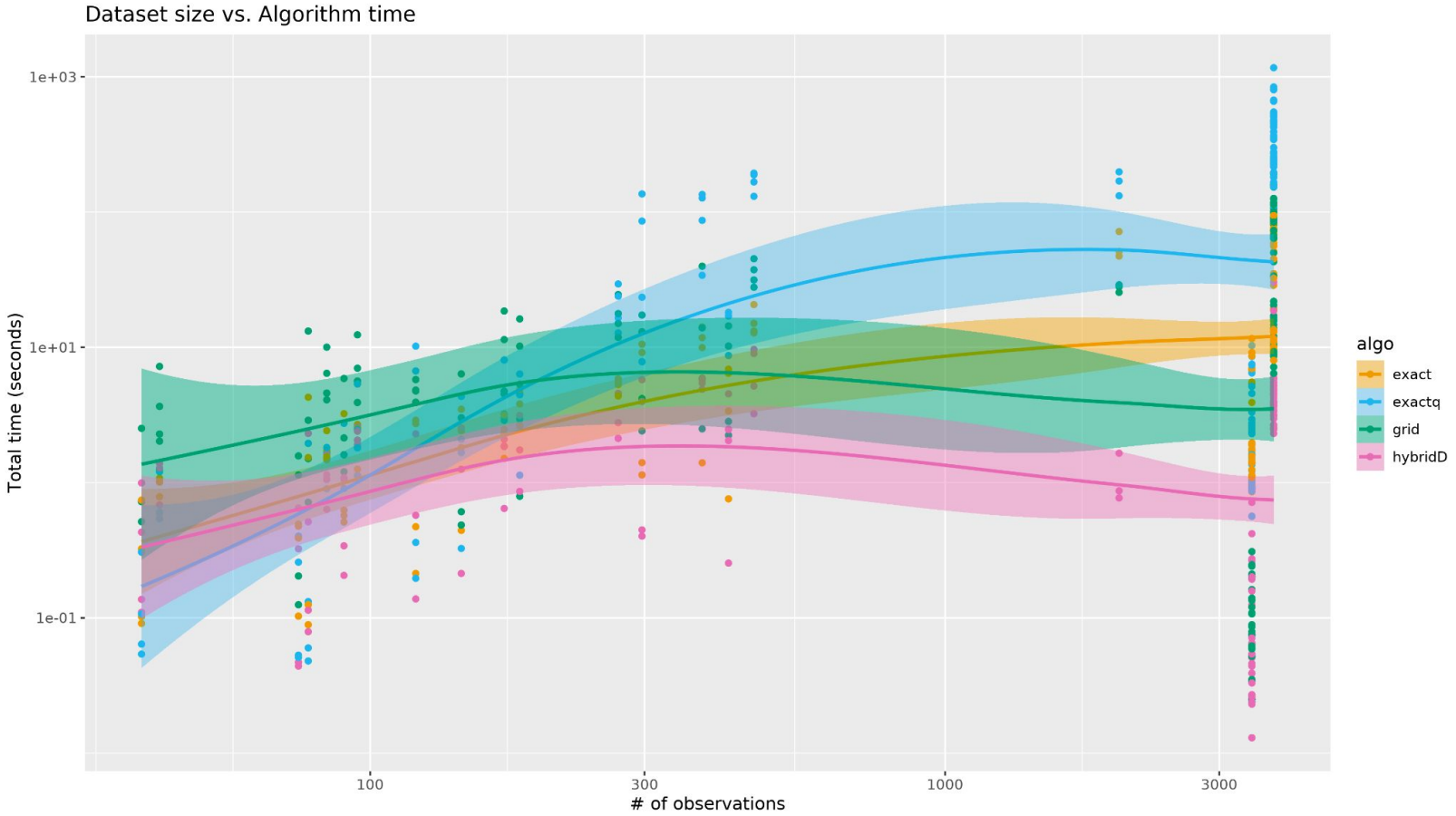
Hybrid increases AUC as fast as Exactq.



Testing against 150/180 folds. Hybrid is performing well in certain datasets.



Boxplot for total time. Hybrid performs the best.



Is there a correlation between dataset size and time taken?

Items left

- Possibly testing more hybrid algorithms
- Testing against even more datasets
- Writing the Algorithm and Empirical Results sections of the paper

Game Developers Conference 2023

Sponsored by Moonsworth, LLC

Lunar Client: a modpack for Minecraft

I work on a *modpack* for Minecraft that adds new features, optimizations, and cosmetics.

- Cosmetic partnerships with YouTubers and Twitch streamers
- Over 1 million MAU
- The founders of Moonsworth and I attended GDC March 18-22.
- San Francisco, CA 🌴

Talks at GDC

Kinds of talks

- Programming
- Game Design
- Business & Marketing
- Production & Team Leadership
- Audio
- Web3

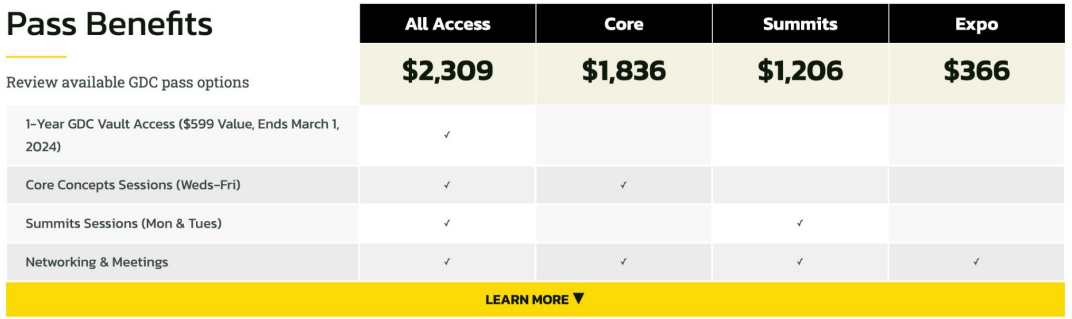
AI Summit & Machine Learning Summit

- Game Bots
- Generative
- Compression

G(atekeeping)DC Prices

- Talks are private & videos require a subscription

- Further slides are *my* interpretation of the talks & my notes



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Core Concepts Sessions (Weds-Fri)	✓	✓		
Summits Sessions (Mon & Tues)	✓		✓	
Networking & Meetings	✓	✓	✓	✓

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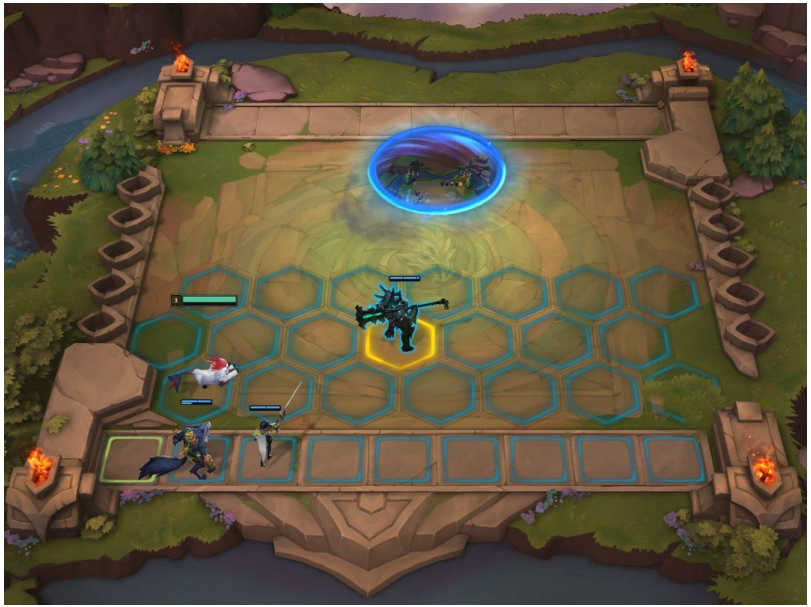
Riot Games: RL For AI Training

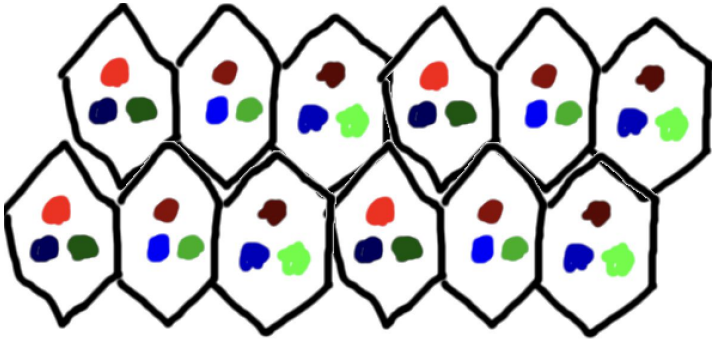
- Teamfight Tactics: round-based strategy game, 8 player PvP
- *Goal*: make an AI for the game that learns how to use new characters and balance changes
- Integrating AI was a large effort, so they remade the game in Python
- Simulating the Python clone is faster than running the full game engine
- Incrementally implemented features in the Python clone to match the real game



Champions fight on a hexagonal grid

TFT AI Architecture

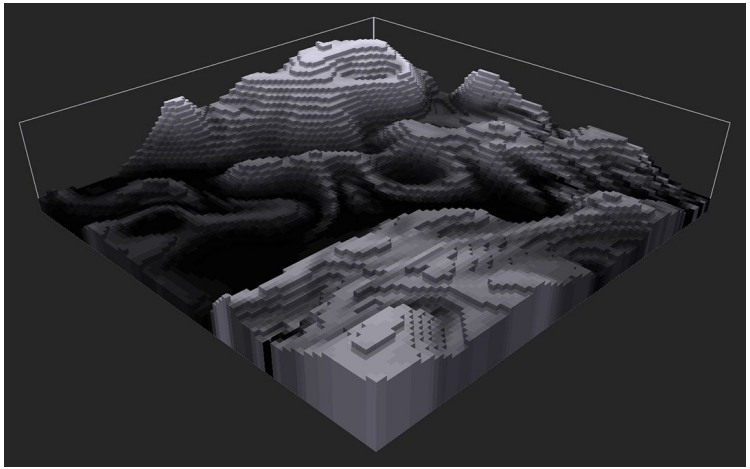
- **CNN**: hex grid -> pixels
  champion embedding -> RGB
- **Transformer**: occupied hex -> word
  hex pos -> word pos
- Performance:
  CNN < Transformer < **CNN + Transformer**
- **Reinforcement Learning**:
  Environment = Python Game, *Agent* = separate Combat Model that accepts *Rewards* from winning games



CNN: Pixel representation of characters on a board

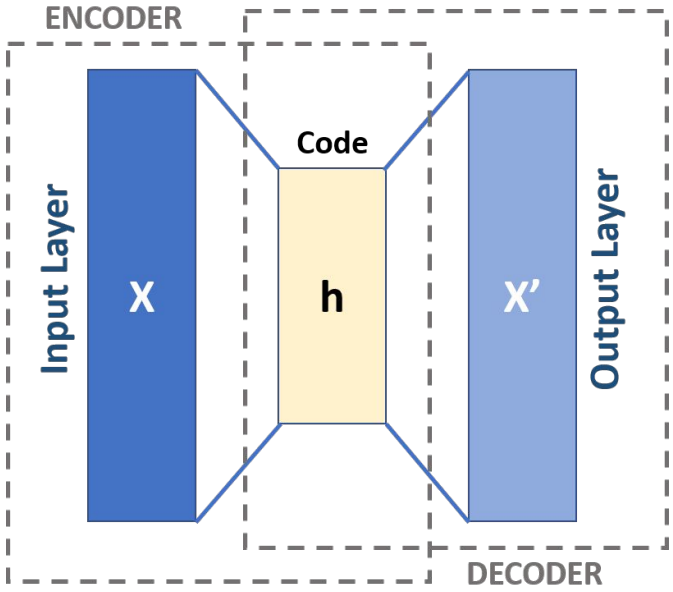
Dune Awakening: Heightmap Compression

- Open World game based on the Dune series
- 8 different biomes with varying terrain
- Heightmap images take up a lot of data (4km^2 = 80MB)
- You could use JPEG, etc, but these aren't good enough: you lose salient features (sand dunes are important in Dune)
- Decompression needs to happen on consumer hardware



Dune: Compression Architecture

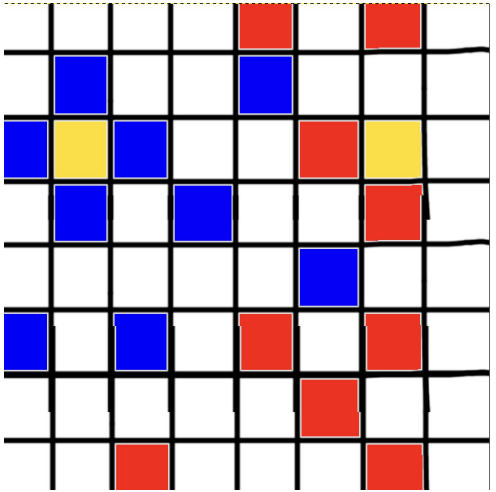
- Autoencoder with a large encoder (1.65M params) and small decoder (1209 params)
- Only the encoder is needed at runtime
- All data is available at train time, no validation needed
- Separate models for each biome
- Achieved up to 36x compression (80MB -> 7.5MB)
- Built with PyTorch, exported to ONNX
- ONNX Runtime was too large, they built their own that compiles ONNX operations to C++ with 0 allocations



Autoencoder, but Dune's decoder is much smaller

ARM: Multi-Agent ML Scenarios in Mobile Gaming

- Test game running on a Google Pixel with two teams of rabbits that hop around and fight each other while defending a tower
- Made in Unity w/ Unity ML-Agents (C#).
- AI split into individual rabbit actions (MLP) and “planner” AI (CNN)
- Planner assigns “roles” to each rabbit (Defender, Attacker, Wanderer) throughout the game
- Rabbit action MLP input is a set of raycasts
- Inference happens at runtime on CPU because the GPU is busy rendering the game



CNN’s view of the field with
red and blue rabbits & yellow towers