Predicting and Planning Outdoor Trips with a COP

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CS 221

Background

When planning and organizing outdoor trips with friends, I find myself spending quite a bit of time exploring and researching different hikes, bikes, campgrounds, and more looking for the best activities with the best conditions for the trip. In an attempt to make this easier, I designed a constrained optimization program that scores different activities based on their forecasted environmental conditions, and can put together a multi-day trip of the best adventures around subject to a user's interests.

Problem Description

Data:

- Activity data scraped from The Outbound Collective. Weather forecasts from the Navteq Destination Weather API. Swell info from Magic Seaweed. Snow reports from On the Snow.

Training Paradigm:

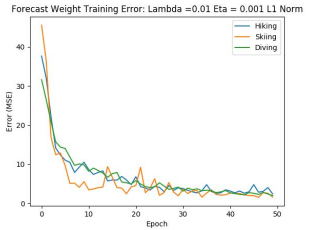
- Presented friends and family with an activity and a forecast and they responded with a number between -10 and 10 depending on how good they thought the conditions were.
- Used MSE and L1 regularization with gradient descent to train weights for each activity type.

Schedule Planner (COP):

- Variables: Adventure and Day
- Domain: Day scheduled or not scheduled
- Constraints:
  - Single Adventure not planned multiple times
  - Every day schedule once
  - Don't travel too far between adventures
- Score: If planned, score from forecast, otherwise 1

Training and Testing

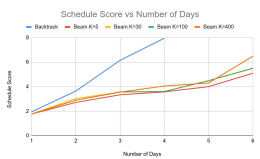
- Feature vector weights trained with home generated data.
- n_train = 300
  n_test = 80
  for each activity

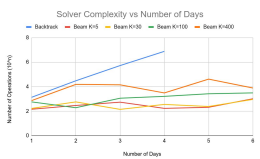


Activity	Train Error (%)	Test Error (%)
Diving	9	13.5
Skiing	5.9	9.4
Hiking	7.3	9.1

Solver Complexity

- Large number of activities makes backtracking search infeasible
- Beam search reduces complexity significantly, but reduces score as well.
- Increasing K by nearly two orders of magnitude marginally improves score.





Running the Schedule Solver

1. Designate number of days, type of activities, and maximum travel distance in config file
2. Let solver run
3. Review results
4. Go adventure!

Input:

max_travel_distance_km: 80
desired_activities: ['Skiing', 'Hiking']
number_of_days: 3

Output:

Activity for Day 1:
Backpack Sam McDonald Park
Activity for Day 2:
Backpack Castle Rock State Park
Activity for Day 3:
Hike the Canyon Rim Route in Butano State Park

Conclusions

In a basic form, the outbound adventure planner works! However, there would be a few more things I hope to continue to add to it. First would be adding training data for every activity, and increasing the training size of the activities I have. Second would be exploiting a few more aspects of my problem to increase speed. The biggest improvement being setting the score of all activities under a threshold to 0. For robustness, I want to implement a random beam search that selects K-n of the top scores to explore and does it a couple of times. Further, I would like to fully incorporate swell and snowpack data. Finally I would like to determine the historical average scores of activities so you can suggest adventures that are unusually good on a certain day.

References

1. Dorsah Sadigh, Percy Liang. CS 221 course scheduling assignment and lecture notes
2.The Outbound Collective. www.theoutbound.com
3. Here. Destination Weather API. https://developer.here.com/api-explorer/rest/auto_weather/weather-observation-lat-long
4. Magic Seaweed Swell Reports www.magicseaweed.com