

# Rideshare Pilots

## Assisted Matching via Planning and Acting in Simulated Environments

**Addison Hanrattie**

**Project link**

University of Maryland  
ahanratt@umd.edu

### Submission Checklist

Done	Item
<u>X</u>	Example completed task.
Prepare Your Code	
<u>X</u>	Push your code to a private GitHub repository. (If your results are not too large, please include your results too.)
<u>X</u>	Be sure your code has all planning models you used in your project.
<u>X</u>	Write a README.md that describes where things are in the repository.
<u>X</u>	Invite makro@umd.edu and dhchan@cs.umd.edu as collaborators to the repository. (I just made it public)
Fill the content (recommended order)	
<u>  </u>	Add your results and evidence
<u>  </u>	Describe your evaluation plan
<u>  </u>	Complete the general discussion of Section 5.1
<u>  </u>	Fill in the Approach section
<u>  </u>	Fill in the background as needed to explain results and approach
<u>  </u>	Write the Introduction
Complete the self assessment (after 12/2)	
<u>  </u>	Copy the <code>grading-template.tex</code> from Piazza into your project.
<u>  </u>	Complete the self assessment.
<u>  </u>	Sign the pledge.
Submit your report (after 12/2)	
<u>  </u>	Create a PDF of this document
<u>  </u>	Submit the PDF to Gradescope, being sure to select the first page for the first question.
<u>  </u>	Email your PDF to makro@umd.edu.

### Assessment

Your report will be distinguished by the following criteria:

- Approach:
  - Clearly states the technical approach of the work in a self-contained way.
  - The acting environment is clearly explained; stronger reports will include an example figure. If the environment started as a Gym environment but was modified, this is clear.
  - Includes a planning and acting component. For the acting, simulation is fine
  - Stronger reports will leverage or manipulate the integration in an interesting way.
- Evaluation:
  - Clear exposition of claims, questions, variables and protocol.
  - Evidence to support the claims in the form of a table or plot and no table or plot has font smaller than \scriptsize (about 6pt font).
  - Plots have axes that are clearly labeled and their captions state their intended meaning.
  - All plots and tables in Section 7 are referenced in the main portion of the paper; supplemental plots that are not referenced should be placed in the appendix.
  - A discussion of findings and how evidence relates to the claims
  - Stronger reports will have a baseline approach; while not required, there is already evidence of this in some reports.
  - It is certainly not required for this report, but you are welcome to include tests of statistical significance if this is something you know how to do.
  - The strongest reports will demonstrate what I call second-order thinking. This is where you conjecture a possible reason for the results you saw. It is even stronger if you run one or more experiments to verify this conjecture or provide analytical results showing why this is the case.
- Scope and Writing
  - Paper tells an interesting or noteworthy story rather than just a chronology of experiments. (Exhibits first-order thinking)
  - Written content is 2-4 pages, excluding floats (figures and tables), and floats are correctly placed in Section 7 to make this assessment easy!
  - Writing is easy to understand
  - Reader is not left "wondering". Consider yourself a teacher of your project. What would your 'student' need to know to understand the content?
  - Grammar is mostly sound; no obvious typos, misspelled words, sentence fragments, etc.
  - Citations are correct and consistent; URLs are fine for hyperlinks, but, generally, books and articles should use a bibtex entry.

Student Assessment: Please complete the orange boxes, replacing text within <.. >. For example, in the first entry you would replace "<replace:{ 1, 2, 3 } >" with "1" if you did a type 1 project. I suggest you change these one at a time and recompile each time to make sure each change is correct.

Description	(your answer)
My project type was	1
My report (Sections 1-6) is this many pages long (for partial pages, use 0.3, 0.5, 0.7):	4.5
My planning system was (add rows if you had more than one)	<replace: planning system >
My acting system was (add rows if you had more than one)	<replace: acting system >
I invested approximately the following time, in hours, for each sprint: (this is for the instructor to assess relative difficulty)	
Sprint 1 : Development	<replace: integer [0,C] >
Sprint 1 : Report Writing	<replace: integer [0,C] >
Sprint 2 : Development	<replace: integer [0,C] >
Sprint 2 : Report Writing	<replace: integer [0,C] >
Sprint 3 : Development	<replace: integer [0,C] >
Sprint 3 : Report Writing	<replace: integer [0,C] >
I answered _____ research questions in my main report	<replace: integer [0,C] >
I included _____ plots in my main report	<replace: integer [0,C] >
I wrote _____ lines of code (excluding comments) for this project	<replace: integer [0,C] >
(If included, these were optional) I added an additional _____ plots in my appendix	<replace: integer [0,C] >
In terms of difficulty compared to other semester projects I have done, I would rate this project as (1-5 scale with 1 being easiest 5 being most difficult)	<replace: { 1, 2, 3, 4, 5 } >
In terms of what I learned, I would rate this (1-5 scale with 1 being "a little" and 5 being "a lot")	<replace: { 1, 2, 3, 4, 5 } >

Name: REPLACE THIS TEXT BY TYPING YOUR NAME HERE

(For this report, typing your name here will suffice)

I pledge on my honor that I have not given or received any unauthorized assistance on my programming project or report.

Instructor Assessment (Mak will fill this in)

Approach	Points Available	Earned Instructor Only
Clear technical approach	5	
Planning Environment (or other system) clearly explained	5	
Acting Environment (or other system) clearly explained	5	
Includes Planning and Acting Component	5	
Evaluation	Points Available	Earned
Clear exposition of claims, questions, variables and protocol	10	
Source code and overall development work	10	
Included baseline approach or ablation study, where appropriate (or demonstrated second order thinking/evaluation)	[5]	
Evidence to support claims is discussed and included in Section 7	10	
Discussion of results	10	
Writing	Points Available	Earned
Clear story arc, paper within scope for project (2-4 pages of writing)	10	
Followed checklist for placing plots and tables and overall structure; all plots are referenced	5	
Grammar and overall writing is sound and citations are proper	5	
Overall	Points Available	Earned
Technical Difficulty (related to project type)	10	
Technical gains considering difficulty	10	

## 1 Introduction

Within the rideshare domain, a very common pain point is connecting with the rider with their matched driver. This is especially true in scenarios where there are likely to be a very large number of riders searching for rides, such as at a concert or sporting event. In these scenarios, it is common for riders to be matched with drivers that are not in their immediate vicinity, and thus the rider must navigate to the driver. This can be a difficult task, especially if the rider is unfamiliar with the area or if there are obstacles in the way.

While much attention in AI planning has been focused on achieving the best possible planning performance and plan quality little attention has been given to leveraging the ability to simulate people as actors in the environment. In this project, we simulate a rideshare user attempting to find their assigned car in a parking lot. Rather than identifying the best possible plan to find the car, we investigate how different environments effect the ability of an agent to find their car when acting in the environment with a simple planning and acting algorithm. This allows us to ultimately draw conclusions about how different environment characteristics effect the ability of an agent to successfully find their car with the hope being that these insights can be used to design better human rideshare experiences in the future. As rideshare services move towards greater autonomy and uniformity in car design, it is important to maximize the efficiency of the particularly human intensive tasks.

## 2 Background

The motivation for this project builds on concepts introduced in earlier work that highlighted a gap in research on the final 100 yards of on-foot navigation within the broader last-mile problem (Samet and Hanrattie). We acknowledge that the difficulties faced by riders in locating their car once in a general vicinity (ie parking lot) are especially unique as compared to simply walking to said area from an original starting location. Prior work has explored the challenges of on-foot navigation in urban environments, but there is a lack of research specifically addressing the nuances of the search task that is rideshare pickup.

This project uses *Run-Lazy-Lookahead*, (Ghallab, Nau, and Traverso), Algorithm 2.4. Briefly, this acting algorithm checks whether the agent has reached the goal. If an existing plan exists and *Simulate* is not failure, it performs the next action in the plan. Otherwise it creates a new plan.

## 3 Approach

### 3.1 Planning Approach

### 3.2 Acting Approach

### 3.3 Environment

Include details about your environment.

If you use a URL link, you can put it in a footnote like this<sup>1</sup> Otherwise, cite it as a reference like usual.

---

<sup>1</sup><https://www.overleaf.com/learn/latex/>

## 4 Evaluation Plan

Discuss the questions you asked and what you were expecting to see.

**Independent variables** Describe the independent variables you varied.

**Dependent variables** Describe the dependent variables you measured.

## 5 Results

Here, simply describe what you found without evaluating it. You'll reference figures and tables from Section 7, as needed.

### 5.1 Discussion of Tradeoffs and Limitations

Describe the key insights of your results. Discuss limitations.

## 6 What I learned

Please describe here a few things you learned from this project.

- <replace with new item >
- <replace with new item >
- <replace with new item >
- <replace with new item >

## 7 Summary Figures and Tables

Here is where you will add figures and tables.

### References

Ghallab, M.; Nau, D.; and Traverso, P. ??? *Acting, Planning, and Learning*. Cambridge University Press. ISBN 978-1-009-57938-4.

Samet, H.; and Hanrattie, A. ??? PILOT: Piloting the Last 100 Yards. In *Proceedings of the 32nd ACM International Conference on Advances in Geographic Information Systems*, SIGSPATIAL '24, 625–628. Association for Computing Machinery. ISBN 979-8-4007-1107-7.

## Appendix

Should you need to, you can add sections here for additional content.

### **A Large Tables or Figures go here**

Table 1 shows an example table using the `\table*` environment. Similarly, Figure 1 shows an example large figure using the `\figure*` environment.

Country List			
Country Name or Area Name	ISO ALPHA 2 Code	ISO ALPHA 3 Code	ISO numeric Code
Afghanistan	AF	AFG	004
Aland Islands	AX	ALA	248
Albania	AL	ALB	008
Algeria	DZ	DZA	012
American Samoa	AS	ASM	016
Andorra	AD	AND	020
Angola	AO	AGO	024
Afghanistan	AF	AFG	004
Aland Islands	AX	ALA	248
Albania	AL	ALB	008
Algeria	DZ	DZA	012
American Samoa	AS	ASM	016
Andorra	AD	AND	020
Angola	AO	AGO	024
Afghanistan	AF	AFG	004
Aland Islands	AX	ALA	248
Albania	AL	ALB	008
Algeria	DZ	DZA	012
American Samoa	AS	ASM	016
Andorra	AD	AND	020
Angola	AO	AGO	024
Afghanistan	AF	AFG	004
Aland Islands	AX	ALA	248
Albania	AL	ALB	008
Algeria	DZ	DZA	012
American Samoa	AS	ASM	016
Andorra	AD	AND	020
Angola	AO	AGO	024

Table 1: Here is a caption for this example table, which came from the overleaf help documents at <https://www.overleaf.com/learn/latex/Tables>.

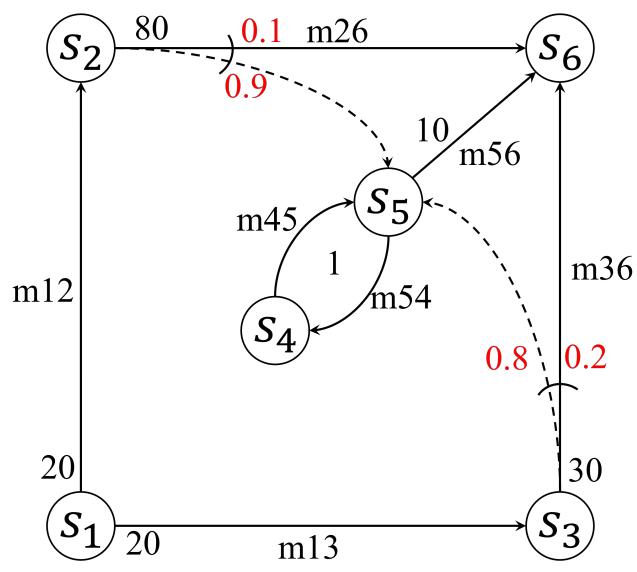


Figure 1: Here is a caption for this figure that you probably recognize.