Amazon Last Mile Routing

RESEARCH CHALLENGE

Supported by the MIT Center for Transportation & Logistics

Informational Pre-Kick-Off Webinar

Advancing the State-of-the-Art in Data-Driven Route Planning

Matthias Winkenbach, MIT Center for Transportation & Logistics
Daniel Merchán, Amazon Last Mile Science

Virtual Event, March 8, 2021

amazon

MIT Center for Transportation & Logistics

Goals of today's webinar

Define the objective of the research challenge
Which problem are we asking participants to solve?

Introduce and explain the data
What information will be provided to participants?

Explain how submissions will be evaluated
What defines a good solution?

Outline the timeline of the research challenge
What are the key dates and what is next?

Respond to questions
What did we not answer yet?

DETAILS ON THE CHALLENGE

Amazon Last Mile Routing Research Challenge

amazon

MIT Center for Transportation & Logistics

Motivation of the challenge

In real-life operations, the quality of a route is not exclusively defined by its theoretical length, duration, or cost. Experienced delivery drivers have **tacit knowledge about the complex operational environment** in which they serve customers on a daily basis.

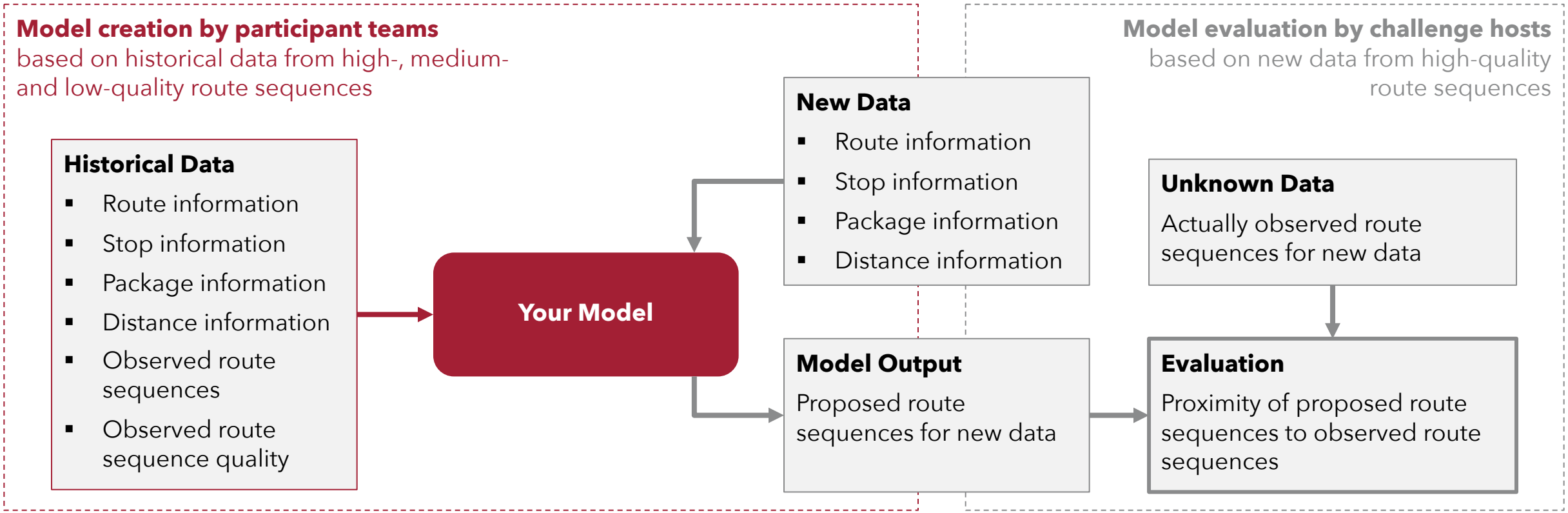
For example, experienced drivers take into account their experience-based expectations of…

- *dynamic **traffic conditions** throughout the day*
- *availability of safe and convenient **parking***
- *customer **availability** for successful delivery*
- *…*

To allow for **safer, more efficient, and sustainable last-mile delivery**, it is critical to leverage this tacit information for route planning.

Objective of the challenge

Solving the route sequencing problem…
Building a model that uses known delivery data and historically observed high, medium- and low-quality route sequences to propose high-quality route sequences for new deliveries for which no observed route sequence is known yet.



The Last Mile Routing Research Challenge is hosted by Amazon and scientifically supported by the MIT Center for Transportation & Logistics

Data that will be provided to participants

Route information

- **Route ID**: unique identifier for any group of stops that has been / needs to be served on a joint route
- **Station Code**: unique identifier of the delivery station that a route starts from
- **Date**: date of route performance
- **Departure Time**: time of day at which route departs
- **Executor Capacity**: volumetric capacity of the delivery vehicle serving a route
- **Stops** to be served on the route
- **Observed sequence** in which stops on the route were served
- **Route Type**: categorical variable denoting the quality of the observed stop sequence (high, medium, low)

Stop information

- **Stop ID**: unique identifier of each stop on a route (unique within each route)
- **Latitude / Longitude**: geo-coordinates of the stop[1]
- **Type**: categorical variable denoting the type of stop (station or delivery)
- **Zone ID**: unique identifier of the geographical planning area that the stop falls into
- **Packages** served at each stop
- **Distances** to any other stop on the same route

Package information

- **Package ID**: unique identifier of each package (unique across entire data)
- **Status**: categorical variable denoting the delivery status of the package
- **Time window** start and end times: delivery time window constraints on some packages
- **Planned service time**: time that serving this package is expected to take
- **Dimensions**: maximum width, length, height of the package

Data from approximately 6,100 routes will be shared in a predefined set of JSON files

[1] anonymized, perturbed and matched to the road network

Evaluation of submissions

Proposed route sequences generated by participant model for a set of previously unknown evaluation routes

?

Known high-quality route sequences for the same set of evaluation routes (benchmark)

How closely do the participant model-proposed sequences match the known high-quality sequences?

Combined Scoring Metric

Sequence Deviation (SD)

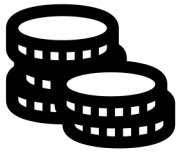
- measure of how different the proposed sequence is from the benchmark sequence, takes values between 0 and 1
- value of 0 indicates that the sequences are identical
- only captures differences in the ordering of stops, regardless of the physical distance between the stops

Edit Distance With Real Penalty (ERP)

- a variation of Edit Distance, a.k.a. Levenshtein distance
- measures the number of single-element operations (insertions, deletions, and substitutions) required to transform the proposed sequence into the benchmark sequence
- operations are weighted by the physical distance of the stops involved

Invalid or infeasible sequences will be penalized with a score of a valid random sequence

Awards and incentives



US$ 100,000
for the winning team

US$ 50,000
for the runner-up team

US$ 25,000
for the third place team

peer-reviewed publication
opportunities for academic papers on the models developed by all participants

academic review paper
featuring the most promising submissions

invitation to present
their work to MIT researchers for members of the top teams

certificate of participation
for all participants

invitation to interview
with Amazon for positions in the last mile science organization for members of the top teams

publicly available
practitioner-oriented report
and media coverage featuring the most promising submissions

The Last Mile Routing Research Challenge is hosted by Amazon and scientifically supported by the MIT Center for Transportation & Logistics

IMPORTANT DATES & NEXT STEPS

Amazon Last Mile Routing Research Challenge

amazon

MIT Center for Transportation & Logistics

Key dates of the challenge

February 22, 2021
Participant registration opens

Registration is now open!

March 15, 2021
Research period starts (data and instructions released)

The research period launches next week!

- Data and further instructions will be released to registered participants on March 15, 2021
- Team formation will happen on a dedicated participant portal
- Preliminary participant eligibility approvals will go out later this week

March 29, 2021
Participant registration closes

May 15, 2021
Optional deadline for participants to submit their preliminary models and obtain feedback on their performance

June 18, 2021
Final submission deadline

July 2, 2021
Deadline to submit a short technical article describing participant submissions

July 30, 2021
Winners will be announced by Amazon

QUESTIONS & ANSWERS

Amazon Last Mile Routing Research Challenge

amazon

MIT Center for Transportation & Logistics

Questions & Answers

Please enter your questions in the Q&A window in Zoom!
You can also upvote other peoples' questions.

We will keep updating the FAQ on the challenge website:

https://routingchallenge.mit.edu/challenge-faqs/

THANK YOU.

Amazon Last Mile Routing Research Challenge

Contact
routingchallenge@mit.edu
routing-challenge-info@mit.edu

amazon

MIT Center for Transportation & Logistics