EURO Meets NeurIPS 2022

Vehicle Routing Competition



Presented by Wouter Kool







VEROLOG VEHICLE ROUTING AND LOGISTICS



TL;DR

Goal: bring together

Operations Research and *Machine Learning*

to solve a *static* and *dynamic* VRP with time windows!

EURO Meets NeurIPS 2022 Vehicle Routing Competition



More info? https://euro-neurips-vrp-2022.challenges.ortec.com/

Organizers

- Wouter Kool (ORTEC)
- Laurens Bliek (Eindhoven University of Technology)
- Danilo Numeroso (Università di Pisa)
- Robbert Reijnen (Eindhoven University of Technology)
- Reza Refaei Afshar (Eindhoven University of Technology)
- Yingqian Zhang (Eindhoven University of Technology)
- Tom Catshoek (Delft University of Technology)
- Kevin Tierney (Bielefeld University)
- Eduardo Uchoa (Universidade Federal Fluminense)
- Thibaut Vidal (Polytechnique Montréal)
- Joaquim Gromicho (ORTEC)

EURO Meets NeurIPS 2022 Vehicle Routing Competition



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Previous challenges

VeRoLog Solver Challenge 2019 ORTEC

2019 Practical Vehicle Routing Challenge



2021/2022 Different VRP problems



2021 ML-oriented TSP solving

Joining forces to organize this competition!

The goal Goal: bring together researchers from Operations Research and Machine Learning

> to push the state-of-the-art in solving a (static and dynamic) Vehicle Routing Problem with Time Windows!

> > ORTEC

Why?

Logistics optimization (vehicle routing) is extremely important to save

Time

Costs

- Environmental impact

- Etc.

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Why?

Operations Research (OR)

- OR researchers also start using ML
- but often 'simple' techniques
- leaving deep learning potential on the table!

Machine Learning (ML)

- ML research for VRP is hot...
- but unable to outperform SOTA OR techniques
- and fair/independent comparison is lacking!

To get the best results, we must bridge the gap between OR and ML



How?



- Starting the competition at EURO (OR) and end it at NeurIPS (ML)
- Bringing together participants from OR and ML community
- Adding real data from US-based grocery delivery service
- Providing a SOTA VRPTW baseline (Hybrid Genetic Search)
- Encouraging ML approaches by GPU availability and dynamic variant

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EURO Meets NeurIPS 2022 Vehicle Routing Competition

NeurIPS 2022 Competition



Introduction

The *EURO Meets NeurIPS 2022 Vehicle Routing Competition* brings together researchers from operations research (OR) and machine learning (ML) to address the vehicle routing problem with time windows (VRPTW) as well as a dynamic VRPTW.

EURO Meets NeurIPS 2022 Vehicle Routing Competition

Organization



Timeline



Some statistics

- 150 teams registered
- 50 teams submitted
- 800 submissions

- 180 people on Slack
- •4500 messages

Active members in your organization

See how many people are active — meaning they posted a message or read at least one channel or direct message.



Weekly active members
 Members who posted

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The Vehicle Routing Problem with Time Windows (VRPTW)

- Vehicle routing problem with limited vehicle capacities
- Every customer must be served within a time window
- Objective: minimize driving duration only*

* Following DIMACS convention we do not minimize vehicles, wait time, etc.





Dynamic variant



 $\sum_{n=0}^{\infty} \frac{x^n}{n!}$

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Instance ORTEC-VRPTW-ASYM-0bdff870-d1-n458-k35



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 $\sum_{n!} \frac{x^n}{n!}$

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Instance ORTEC-VRPTW-ASYM-01829532-d1-n324-k22



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 $\sum_{n!}^{x^n}$

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Quickstart for EURO Meets NeurIPS 2022 Vehicle Routing Competition

Quickstart code for the EURO Meets NeurIPS 2022 Vehicle Routing Competition.

Introduction

The EURO Meets NeurIPS 2022 Vehicle Routing Competition focuses on the classic Vehicle Routing Problem with Time Windows (VRPTW), as well as a dynamic variant in which orders arrive at different epochs during the day. Important: all submitted solvers compete *on both problem variants*, which is facilitated using the provided baseline strategy to use a static solver to solve the dynamic variant. The complete description of the problem setting is provided on the main webpage of the competition.

This repository provides all the necessary code to start the competition. It includes a simple baseline method based on HGS-VRPTW as a static solver, along with examples of the use of the controller code designed to evaluate the algorithms.

Stay updated!

Note: we will keep updating this repository with additional baselines, tools, information about code submission etc. to help you get most out of this competition! To stay updated, check back regularly, follow us on Twitter and join the Slack workspace, which is also the place to ask questions! Don't forget to register your team!

Installation

The evaluation scripts are provided in Python, and the baseline solver (HGS-VRPTW) is implemented in C++. We recommend to create a virtual environment using Python 3.8+ to run the codes. Therefore, make sure that Python is installed, along with venv and a C++ compiler and make. On Windows, we recommend using Visual Studio or using MinGW and installing make through Chocolatey (run choco install make as administrator). Then, run the following commands (Linux or Mac OS):

https://github.com/ortec/euro-neurips-vrp-2022-quickstart

Quickstart on GitHub

- Data
- Environment
- Baselines:
 - Hybrid Genetic Search (static)
 - Greedy/Lazy/Random (dynamic)
 - Supervised/RL + GNN/DQN (dynamic)
- Tools
- Controller
- Codalab submission instructions

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Code submission

- CodaLab platform
- GPU workers on SURF cluster
- To make submission run as jobs:
 - Docker -> Singularity
 - Custom worker that stops when queue empty
 - Monitoring script to spin up jobs
- Custom leaderboard
- Hourly logging of leaderboard
- Allowed 1 submission/day
- Testing 'phase' + qualification

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EURO Meets NeurIPS 2022 Vehicle Routing Competition	EURO N Organized by	/eets Neu / wkortec - Curre	rIPS 2022 Ve nt server time: Nov. 8	hicle Routing Con 2022, 10:08 a.m. UTC	npetition				
Previous Qualification Aug. 1, 2022, midni				Current Final (hidden) Nov. 1, 2022, midnight UTC	End Competition Ends Nov. 30, 2022, midnight UTC				
Learn the Details	Phases	Participate	Results						
Get Data Files Submit / View Resul	ts	Test C Phase d Use this fo 10 minute Max subr Max subr Max Subr Click the Optione	aulification Final (hi escription or testing if your su s. hissions per day: 10 hissions total: 250 hission Size: 300 m Submit button to u	iden) omission can be evaluated 10 egabyte(s) pload a new submission. nation about this submissie	on our system. Your	code should be ab	le to install wi	thin	
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Overall rank (daily)



2022-08-15

2022-10-15

2022-11-01

Rank Date Team Static cost

Dynamic cost Avg. cost

Dynamic Static

Rank

Rank

Avg. rank

	Rank	Cate	Team	Static cost	Oynamic cost	Aug. cost.	Static Ratik	Dynamic Rank	Ag.	/
	1	20/30/22	Kliopatra	180639.6	333490.8	2.57052++05	50		3.0	
	2	30/30/22	OpsML	180639.1	339331.4	2.595852+05	40	2.0	3.0	
	4		Team_50	180565.4	340115.4	2.648404++05	2.0		40	
	s	10/29/22	CRiberto Hood and	180677.0	340394.9	2.633860+05	80	40	60	
•	•	10/30/22	ups	180670.8	3409022	2.6500(5e+05	7.0	7.0	7.0	
	7	30/31/22	Miles To Go Defore	180562-9	352776.8	2.000000+05	1.0	13.0	7.0	
		30/31/22	Kechlofidew	100575-3	25340.5	2.670093e+05	30	25.0	9.0	
MI - XXI	9	30/20/22	dynamo	100728.3	350960.3	2.058443±+05	12.0	8.0	10.0	
	10	35/26/22	Hadferart	180799.3	340912.7	2.638310+05	160	5.0	10.5	• •
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∧ - N	15	09/29/22	The Symbolic Routers	180700.3	357202.3	2.6855134+05		26.0	18.5	١
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	21	30/21/22	DryRiceNing	100735.2	291308.0	2.850216+05	13.0	340	22.5	١
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N 18 - Wi	28	30/31/22	Team_Opt400	182981.5	252471.3	2.667264±+05	48.0	12.0	30.0	1
	29	30/05/22	hq	10082.9	25461.9	2.676324e+05	400	22.0	31.0	•
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NS4.412	33	01/28/22	50	100245	4131287	2.9637664+05	180	45.0	33.5	1
SARVINI	34	30/31/22	HUS71012	180953.0	354023.9	2.675380e+05	47.0	23.0	35.0	
	25	10/12/22	WRSA	100942.6	201226.3	2.800345e+05	28.0	42.0	25.0	1
8.481-18M	30	09/15/22	Learning@cute	180942.6	291226.3	2.8603458+05	280	42.0	25.0	1
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1 846 18	39	09/07/22	Supervised Learning Beseline	100038-8	429007.3	3.002680+05	25.0	50.0	37.5	
	40	30/31/22	ww	181338.9	255340.9	2.683444±+05	52.0	240	38.0	
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2411-1213	44	01/22/22	A32	1000014	2011112	2,859303++05	400	35.0	39.0	
	45	30/31/22	EML	100146394.5	355908-4	5.025115e+07	53.0	25.0	39.0	
	45	08/01/22	Greedy Tasseline	180806.8	201207.3	2,860320++05	42.0	38.0	40.0	
	47	30/31/22	Mos	100942-6	429756.9	3.403048+05	28.0	52.0	40.0	
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A	50	30/31/22	PMF	180024.9	2011246	2,850748++05	400	37.0	49.0	
22	51	30/15/22	401	181132.7	301122.7	2.861277e+05		36.0	-0.5	
1		10/14/22	1073	100852.9	203471.8	2.8136234405	400	47.0	40.5	

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1	10/30/22	Kléopatra	180639.6	333490.8	2.570652e+05	5.0	1.0	3.0
2	10/30/22	OptiML	180639.1	339331.4	2.599852e+05	4.0	2.0	3.0
3	10/30/22	HowToRoute	180565.4	349115.4	2.648404e+05	2.0	6.0	4.0
4	10/31/22	Team_SB	180686.6	341169.1 2.609278e+05		9.0	3.0	6.0
5	10/29/22	ORberto Hood and the Barrymen	180677.0	346094.9	2.633860e+05	8.0	4.0	6.0
6	10/30/22	UPB	180670.8	349342.2	2.650065e+05	7.0	7.0	7.0
7	10/31/22	Miles To Go Before We Sleep	180562.9	352776.8	2.666698e+05	1.0	13.0	7.0
8	10/31/22	Kirchhoffslaw	180575.1	353443.5	2.670093e+05	3.0	15.0	9.0
9	10/20/22	dynamo	180728.3	350960.3	2.658443e+05	12.0	8.0	10.0
10	10/26/22	HustSmart	180799.3	346982.7	2.638910e+05	16.0	5.0	10.5

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Leaderboard prizes



1 2 3 leaderboard_prize

UPB	7	1	0	380
Kléopatra	3	1	0	180
Team_SB	2	2	0	160
4pd_vrp	0	5	0	150
OptiML	1	2	2	150
HowToRoute	0	0	4	80
The Symbolic Routers	0	1	1	50
play_vrp	0	0	2	40
UBD	0	1	0	30
Quickest Route	0	0	1	20
Miles To Go Before We Sleep	0	0	1	20
ORberto Hood and the Barrymen	0	0	1	20
DMR_AJ	0	0	1	20



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The finals

- Top 10 solvers from qualification phase
- 100 new instances (from same source)
- +- 2x longer runtimes
- Results announced at NeurIPS 2022 virtual workshop

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- Prizes (5000+ euros):
 - 1st/2nd/3rd: 2022/750/500 euros
 - Jury prize: 250 euros
 - Young talent prize: 250 euros
 - (Leaderboard prizes: 1300 euros)

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NeurIPS 2022 Virtual Workshop

- Keynote presentation
- 5-minute presentations of finalists

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- Announcement of results
- Socials/discussion
- Wednesday Dec 7th 13:00-16:00 UTC (check local time online)

https://neurips.cc/virtual/2022/competition/50085

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NEURAL INFORMATION PROCESSING SYSTEMS

Competition

EURO Meets NeurIPS 2022

Vehicle Routing Competition

Wouter Kool · Laurens Bliek · Yinggian Zhang ·

Kevin Tierney · Eduardo Uchoa · Thibaut Vidal · Joaquim Gromicho Virtual

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Uploads...)

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