Unleashing Innovation for Urban Traffic Solutions

Context

The city of Porto is the second biggest city in Portugal; it spans over 41.42 km^2 and is home to 231.800 inhabitants. In the past years, Porto has been crowned a top destination multiple times, and it is known for its vibrant and growing community.

Porto is the heart of the Porto Metropolitan Area, which includes 17 municipalities. This metropolitan integration is not just about geography. It encompasses a complex network that supports social, economic, and cultural cohesion in variable geometries of collaboration. The Porto Metropolitan Area stands out for its interesting transport infrastructure, including the Francisco Sá Carneiro Airport and a comprehensive metro and bus network that streamlines the movement and connection between cities.

Porto's situation in the Porto Metropolitan Area is particularly significant regarding mobility and the daily commute. Every day, 160.336 people commute regularly into the city for work and study, taking advantage of the transportation network system that connects this area.

However, despite the strengths of an integrated transport system, Porto faces relevant challenges with traffic congestion, particularly during peak commuting hours. The daily influx of people into the city results in an increase of about 70% in the city's population during the day, which puts a lot of pressure on the city's mobility infrastructure and could help explain the phenomenon. Adding to this, there are changes in city dynamics that come from city-wide construction projects (e.g., new metro lines and metro buses) and changes to the preferred means of transportation. Moreover, there are some limitations in the public transport system that still need to meet the community's demands fully, and there are also constraints of complex urban planning due to Porto being a historic city built on a hill.

Despite this, Porto is trying to change and adapt to create a better public transport infrastructure and is working to prioritize soft transportation areas and lanes. Further, Porto is implementing several P+R (Park & Ride) locations to enable the interchange of private vehicles with public transport.

The Municipality of Porto created Porto Digital to promote ICT projects within the context of the city of Porto and its metropolitan area. The Municipality of Porto

assigned to Porto Digital the responsibility of maintaining and expanding the telecommunications and IoT infrastructure of the city of Porto (in particular, the optical fiber and Wi-Fi networks and the city sensors) and the task of developing an urban platform to consolidate data in the areas of mobility, environment, energy, and civil protection. Therefore, Porto Digital is a key player in the design and implementation of smart and sustainable city strategies and policies, which contribute to a better quality of life for Porto's inhabitants, workers, entrepreneurs, visitors, and tourists.

One of the main goals for the coming years is to find ways to utilize and create value from our datasets. With this focus, we want to release a challenge to use municipality data to develop new insights, dashboards, and indicators, but always with a critical mindset towards the quality and preparation of the available datasets or new data sources.

One possible application of the available open data is to create indicators that can show the current state of areas of interest for city governance while providing decision-makers and city planners tools to support the design of local policies that effectively contribute to urban sustainable planning. These can be simple indicators based on data analysis and insights from the daily urban activity data, or advanced indicators developed using more intricate analysis techniques and approaches.

Topic

Porto launched the Porto Climate Pact, a local green deal uniting companies, organizations, and citizens in the collective goal of reaching carbon neutrality by 2030.
Furthermore, Porto has been recognized as one of the 100 Mission Cities in the Horizon Europe climate-neutral cities Mission, currently developing a robust Climate City Contract.

To become carbon neutral by 2030, Porto is looking for research data-driven solutions for managing city mobility more intelligently and sustainably. This should be accomplished by developing indicators that facilitate the understanding of traffic impact on the city and suggest more rational decisions regarding traffic rerouting on specific roads to minimize the environmental impact of such resources (e.g., reducing traffic emissions such as CO2, CO, NOx, PM2.5, PM10, etc.).

Goal

The goal of this challenge is to find practical and useful solutions for city traffic management by addressing the following questions:

- How can we evaluate the impact of a road constraint?
- How can we manage traffic and mobility in the city of Porto in a way that helps the city towards its carbon neutrality goal?
- How can we improve the flow of traffic in the city?
- How should we reroute the traffic in the city to reduce traffic emissions?
- What kind of characteristics or features of a road/street should be considered when rerouting the traffic in the city?

Outcome

The challenge will consist of four parts. Participants are expected to:

1. Develop an idea for a visualization/dashboarding tool for planning and operations teams to define more efficient processes and evaluate the impact. This tool can be a sketch, where each component should be presented with its respective process (from the data used, exploratory analysis performed, preprocessing, to the creation of metrics/KPIs).
2. Develop predictive models that allow:
    a. Assessing the impact of a road closure in the city and the rerouting of the traffic options;
    b. Exploring ways to adjust road closures, thereby minimizing the environmental impact on the city (e.g., reducing traffic emissions such as CO2, CO, NOx, PM2.5, PM10, etc) of different reroutes options.
3. Present conclusions and potential solutions, enabling stakeholders to address the problem effectively. This will facilitate the formulation of contingency measures and ensure their practical relevance.
4. And evaluated independently for the Data Quality Award: Suggest other datasets, data services or tools that may be useful in solving the proposed problem (all participants should consider whether the sources and data comply with GDPR).

Submission: Please refer to the participant's guidebook for the submission instructions.

Available Resources

The data shared within the context of Hackacity 2023 by Porto Digital, and the Municipality of Porto can only be used for the purpose of the event. All data must be deleted at the end of the competition.

As a reminder, you can also use any data that is open, free, and legally available.

The following list of resources is available for you to use:

Hub Virtual/Toolbox

- E-Scooter Mobility Trips Data as an Origin-Destination Matrix;
- City Sensors Data as time series for meteorological, air quality, and noise sensors;
- Public Transportation Data as the number of validations per hour by operator and station.
- Traffic Data as Vehicle count in a given space and time.
- Available spots in Parking Lots.

Orion Context Broker (Urban Platform)

API Endpoint: toolbox.portodigital.pt/v2/types
API Doc: https://fiware-orion.readthedocs.io/en/1.13.0/user/walkthrough_apiv2/index.html

- Points of Interest as descriptive and geolocation data;
- Information related to accidents, public road cuts, and construction work.

Open Data Portal for Hackacity

Website: https://data-hackacity.portodigital.pt/

- Static Data as GTFS/Geolocation (Metro + STCP);
- Varied several geolocation data from the City of Porto;
- Other municipal data.

Tips

- Think of metrics and indicators that are actionable! Don't forget that the goal is to help city managers to make better-informed decisions.

Further Background Information

Papers and Studies:

- Check the attached files.

News (in Portuguese):

"VP da CMP, em entrevista: a visão, desafios, objetivos e expectativas sobre a neutralidade carbónica e o município do Porto":
https://eco.sapo.pt/entrevista/a-cidade-do-porto-tem-como-maior-desafio-ambiental-alcancar-a-neutralidade-carbonica-ate-2030-diz-filipe-araujo-vice-presidente-da-camara-municipal-do-porto/

"Implementação de uma rede de percursos prioritários para meios de mobilidade suave":
https://www.porto.pt/pt/noticia/criada-rede-20-para-tornar-o-espaco-publico-disponivel-para-todos

"Ciclo de conversas rumo à neutralidade 2030: Mobilidade sustentável":
https://eco.sapo.pt/2023/05/17/ciclo-de-conversas-2-mobilidade-sustentavel/

"Projeto europeu com a Via Verde com o propósito de acelerar o caminho para a neutralidade carbónica na área da mobilidade":
https://jornaleconomico.pt/noticias/via-verde-e-a-to-be-participam-no-projeto-gemini-com-dotacao-de-12-milhoes/

"Problemas de trânsito na cidade":
https://portocanal.sapo.pt/noticia/315441
https://portocanal.sapo.pt/noticia/336161

"Entrevista Álvaro Costa SIC | Trânsito no Porto"
https://www.youtube.com/watch?v=TFifaQBO8Ng