REACH

NEXT GENERATION DATA INCUBATOR

EXPLORE PHASE TECHNICAL SPECIFICATIONS

22/05/2023

This project has received funding from the European Union's H2020 research and innovation programme under Grant Agreement no 951981

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1 ANNEX I. Technical Specification Double-side Page

1. **TECHNICAL SCOPE:** The mock-up solution is suitable and correctly addresses the challenge/theme selected over the REACH dataset/s. The Big Data solution architecture proposed is adequate to tackle the data management issues associated to the solution in mind. "To what extent does the applications handle the data provided?"

The ENTICE project's mock-up solution appropriately addresses Migros' Ready Made challenge 3, focusing on object detection and tracking within refrigeration units. To adapt to the small office-based dataset, we included images from real-world supermarket and gas station scenarios, specifically with beverage refrigerators. Our architecture is equipped to manage the data without relying on a big data solution, utilizing computer vision techniques instead.

Our application processes images, extracts object information, and tracks their movement. Product movement data is sent in real-time, but no images are stored after processing to save storage and maintain privacy. Overall, our application effectively handles data, presents a scalable solution for the challenge, and meets the technical requirements of the Jetson Nano 4Gb platform.

2. **SELECTION OF ALGORITHMS AND TOOLS:** The indicated Data Science approach, i.e. algorithms chosen, and Big Data architecture approach, i.e. tools chosen may successfully accomplish the required data governance, processing and analysis. A clear understanding of the used REACH dataset/s is demonstrated.

The technical framework behind the ENTICE project has been carefully crafted, making use of advanced algorithms and tools precisely chosen for their potential to tackle this unique challenge. Our strategy is rooted in the principles of Machine Learning and Computer Vision, allowing us to effectively detect and track objects within images captured from refrigeration units.

Our solution is fundamentally based on Convolutional Neural Networks (CNNs), recognized for their superior performance in image classification tasks. We leverage pre-trained models for object detection (such as YOLO, SSD, or Faster R-CNN) that have shown excellent performance in similar tasks, using the principle of transfer learning for our defined set of SKUs. To track the detected objects in subsequent frames, we employ algorithms like DeepSORT or IOU Tracker, which consider both the appearance and motion of the objects. These carefully selected algorithms allow the system to accurately identify and track the trajectory of products selected by customers.

On the hardware side, the choice of the Jetson Nano 4Gb is a cost-effective solution to run our CNN models. While its GPU power may be limited, we are committed to optimizing all networks and algorithms to ensure robust performance. Achieving efficient operation on such a platform presents an exciting challenge and underscores our commitment to creating scalable and accessible solutions.

Regarding the use and understanding of the REACH dataset, we have strived to augment the dataset with additional real-world images from supermarkets and gas stations, thereby enhancing the diversity and representativeness of our models. While we've done our best to augment the dataset for the mock-up, we eagerly anticipate feedback from Migros on May 23rd to ensure our efforts align with their expectations and requirements.

In conclusion, the choice of algorithms and tools, along with the planned data handling and communication strategies, form a well-rounded solution that addresses the complexities of data governance, processing, and analysis pertinent to the Migros challenge. This approach ensures our solution is poised for scalability, efficient resource utilization, and excellent performance.

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3. **TECHNICAL SCALABILITY AND FLEXIBILITY OF THE SOLUTION:** The solution can truly cope with humongous and increasing datasets, potentially from diverse data providers, and is flexible it to adapt to other related domains.

The foreseen solution has been designed with scalability and flexibility in mind to adapt effectively to large and increasing datasets, potentially from diverse data providers, and to be able to transition smoothly to other related domains.

The system architecture is based on a modular detection approach, making it easily scalable in hardware and system terms. This approach allows for expansion or contraction depending on the complexity and the size of the task at hand. The use of context brokers for data communication adds to this scalability, facilitating efficient, real-time central data management without creating system bottlenecks.

In terms of data scalability, we have contemplated a method to adapt to the dynamic environment in supermarkets. We propose the use of different detection zones, each with their own specialized datasets and anomaly management strategies. This stratified approach can effectively manage diverse and ever-increasing data, thus enhancing the robustness of our solution.

Our solution's flexibility is also noteworthy, as it is not tied to any specific data provider and can be easily adapted to new environments or requirements. The underlying detection and tracking technologies are universally applicable, which allows the solution to be extrapolated seamlessly to other data providers and related domains. This inherent flexibility makes our solution a robust choice for a wide range of object detection and tracking applications.

4. **DATA GOVERNANCE AND LEGAL COMPLIANCE:** Data sharing challenges, data governance and legal compliance, must be observed. The proposed solution is compliant with the current data legislations concerning security and privacy (e.g. GDPR).

The proposed solution under the ENTICE project upholds high standards of data governance and legal compliance, paying particular attention to regulations such as GDPR.

Given the nature of our system, no images are stored post-processing. This approach aligns with standard GDPR practices for CCTV surveillance in retail environments and mitigates any potential privacy concerns. Our focus is purely on object detection and tracking, with no consideration given to identifying individuals within the images.

However, to ensure further compliance and privacy protection, our solution has the capability to incorporate a face-blurring algorithm, if required. Although we believe this might not be necessary due to our image handling policy, we remain open and adaptable to implementing this feature for enhanced privacy assurance. In doing so, we would ensure a balance between operational needs and privacy rights, all the while remaining fully compliant with prevailing data privacy laws and regulations.

5. **QUALITY ASSURANCE AND RISK MANAGEMENT:** Feasible and credible quality process followed for the final product generation. The potential risks in all the phases of the project (design of the solution, development, testing, deployment…) are identified and convincing mitigation plans put in place.

Leveraging our extensive experience in Computer Vision solutions, ROVIMATICA is committed to adhering to stringent quality standards throughout the ENTICE project. Quality assurance will include meticulous design, regular code reviews, rigorous testing, and prompt issue resolution. Risk management involves comprehensive risk analysis at each project phase, with detailed mitigation strategies already devised and an even more extensive analysis planned for the next incubation phase. This approach ensures robust contingency planning and project continuity.

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