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This document is prepared by EuroCC@Turkey for EuroCC under GA NO 951732

## CASE STUDY REPORT

### Hyper Parameter Optimization for Continuously Learning ML Algorithms

<b>NCC Partner</b>	<i>ITU UHEM</i>
<b>Company*</b>	<i>TAZI - <a href="https://www.tazi.ai/">https://www.tazi.ai/</a> Tanju ÇATALTEPE - <a href="mailto:tanju@tazi.ai">tanju@tazi.ai</a></i>
<b>Expert</b>	<i>Belgin Övet – <a href="mailto:belgin.ovet@uhem.itu.edu.tr">belgin.ovet@uhem.itu.edu.tr</a> Erva Marangoz – <a href="mailto:erva.marangoz@uhem.itu.edu.tr">erva.marangoz@uhem.itu.edu.tr</a> Kübra NARİ – <a href="mailto:kubra.nari@uhem.itu.edu.tr">kubra.nari@uhem.itu.edu.tr</a> Enver Özdemir – <a href="mailto:ozdemiren@itu.edu.tr">ozdemiren@itu.edu.tr</a></i>

\***Company** accepts that the Case Study Report is shared with the EuroCC Project and the community through the EuroCC@Turkey awareness creation activities and platforms.



## 1. Problem Identification

TAZI has an adaptive ML platform upon which it offers ML solutions for its customers, especially in the insurance and finance sectors to classify their users and users' behavior. In other words, the problem that TAZI handles is in the general area of high-performance data analytics and artificial intelligence. TAZI continues to develop and improve its adaptive ML platform and builds Machine Learning (ML) solutions and large-scale systems for academia and industry. Their customer portfolio includes insurance, finance, retail, healthcare, and telecoms. Their core business is AI, they don't own an adequate large-scale infrastructure and are getting such service from public cloud companies. They frequently need hybrid systems for training data and performance testing of their platform during their development process.

TAZI needs supercomputing resources in HPC systems in their business area and aims to utilize HPC resources to be able to perform scaling and load tests of their ML-based solutions most specifically for their anomaly detection platform. As their ML platform systems have to satisfy requirements such as response time, continuous service availability and accurate outputs, using HPC resources will help them to accomplish these goals.

## 2. First Suggestion

TAZI has updated the genetic algorithm which uses for hyperparameter optimization. TAZI had an internal plan to identify which platform parameters to expose for the optimization search space. The parameters taking continuous values required special consideration. The team decided to handle them with user-controlled quantization.

UHeM infrastructure will provide TAZI a customized hardware environment to conduct experiments with various data sets to determine initial settings for the platform users to speed up hyper-parameter optimization on its customers' more modest infrastructures.

The tentative project plan is as follows:

<b>Timeline</b>	<b>Tasks and Milestones</b>
<b>May 2022</b>	Orientation for TRUBA and UHeM systems
July 2022	Integrate TAZI platform to UHeM's systems
September 2022	Perform analysis for TAZI platform at UHeM's system



The steps are as follow that required for the phase of integration and usage of platform TAZI into UHeM systems:

S.1	Determining the hardware architecture of server for the needs of TAZI experiments.	Completed
S.2	Prepare the testing bed server and make it ready for the use of SME.	Completed
S.3	Installation of TAZI platform on the test bed in UHeM.	Completed
S.4	Conducting test with the competitors of TAZI.	Completed
S.5	Analysis test results and determine a road map for improvement of TAZI platform.	Completed
S.6	Re-test updated platform	Completed

### 3. Solution Stage – I

TAZI provides services to institutions in various sectors by developing AI/ ML tools. In this context, it needs numerous tests and developments to improve service quality. Various tests that require to high processing power have been carried out, and improvements were observed for TAZI in line with the results through the integration of TAZI into UHeM. In addition to these tests, a comparison result table will be obtained by performing the necessary tests in the alternative/competing applications. In the next stage, projects for development would be continued according to the advantages/disadvantages compared to alternative/competing applications. TAZI's goal is to ensure an AI/ML-based system tools that provide fast and accurate responses. Using HPC resources during the development of the TAZI helped them to achieve these goals.

As shown in the table in Section 2, as the first step, a servers set in UHeM has been prepared according to technical requirements and the other necessary 3rd party applications have been installed for the installation of TAZI. After that, TAZI was installed and demo tests have been currently conducted for various purposes.

### 4. Solution Stage – II

In TAZI platform, the user must define which TAZI parameters should be investigated with their value intervals. These include the number of iterations, population size, number of simultaneous models, mutation rate, mutation method, selection method, crossover method, and offspring fraction. Testing the platform with a high number of iterations and a large population size requires strong computational power. High-performance computing enabled TAZI to test the platform's further optimization capacity and helped develop an overall hyperparameter optimization strategy. Having the platform offer initial settings for the platform users to speed up hyper-parameter optimization process has become the objective.



TAZI has been provided by a small scale supercomputer hybrid system in UHeM's facility. Each server in the system has two CPUs where each CPU has either 12, 14, 20, 32 or 64 cores. The tests' results indicate that TAZI platform has best results for the system has 2 CPUs with a total of 40 cores.

## 5. Results and Achievements

- Benchmarking were enforced on the test bed UHeM for the improvement of TAZI platform.
- Initial tests have been performed in the HPC environment.
- Further testing strategy has been discussed.
- First training session took place for the users on how to use the platform.
- The Platform will be open to use by academicians for their research projects.