# VMC Consulting

# ADVANCED GAUSSIAN PROCESS

## Specification

# Advanced Gaussian Process (AGP) Machinel Learning algorithm: same precision of Kriging, much faster.

Artificial intelligence and optimization tasks in general rely on regression and classification models to forecast the response of a given function or pattern, in what is called machine learning (ML). ML models like kriging (KR), support vector machine (SVM) and artificial neural network (ANN) are popular choices in the field.

KR is known as the most precise ML model, with precision error level around 0.01% for regression. Yet its common bottle neck limitation is the elevated computation costs related to training for large datasets, significantly limiting its application for bigger projects.

The Advanced Gauss Process (AGP) is a novel patented algorithm which has the same accuracy of the KR model for regression or classification, with a training speed increased hundreds of times for larger datasets. This allows to significantly scale up ML inferences with KR precision for large or very large patterns of +100k inputs, with affordable training costs. Figure 1 displays computation costs of the KR model versus AGP while using a single processor Apple M1.
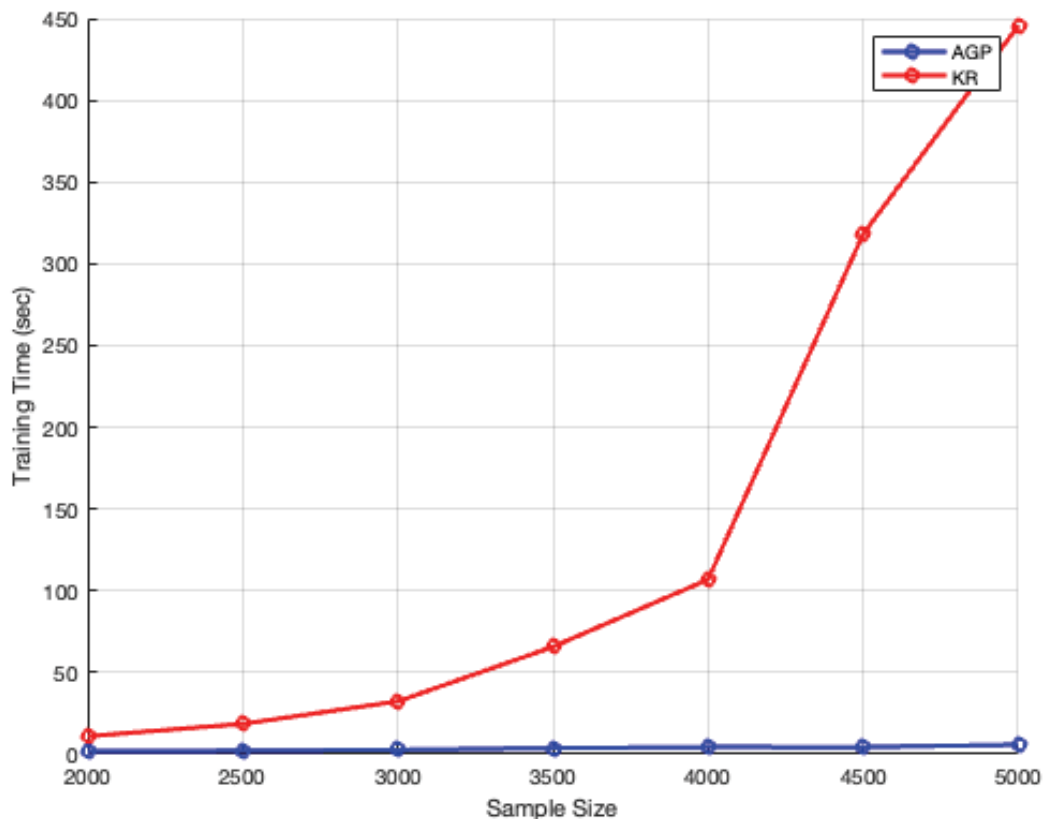


**Fig. 1** - Computation costs of KR and AGP vs dataset size

Table 1 displays the values of Figure 1 related to training time cost for each model. Is possible to see that for a dataset with 5000 inputs, KR training took 7 minutes and 25 seconds, while for AGP, the training time was of 5.9 seconds, a training speed increase of 75 times for a dataset with 5000 inputs, with same KR precision. Considering the AGP model has the same precision of the KR model, it represents an important development in the domain of ML, providing both accuracy and low training times.

The AGP model can work with a dataset with any type of distribution such as Cartesian, random, or clustered, and has no operational parameters to be adjusted beside usual KR parameters.

A free 10 days trial license of the AGP MATLAB app with regression metamodel benchmark functions is available to download at www.vmc-consulting.net.

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--------------------------------------------------------------
dataset size |                KR |          AGP |    ratio |
--------------------------------------------------------------
1500         |          4.71 sec |     1.95 sec |     2.42 |
2000         |         11.03 sec |     1.81 sec |     6.08 |
2500         |         18.62 sec |      2.2 sec |     8.48 |
3000         |         32.35 sec |     2.71 sec |    11.95 |
3500         |     1 min 5.76 sec |     3.77 sec |    17.44 |
4000         |    1 min 46.92 sec |     4.45 sec |    24.04 |
4500         |     5 min 18.22 sec |     4.4 sec |    72.37 |
5000         |     7 min 25.57 sec |    5.89 sec |    75.61 |
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```
**Tab. 1** – Computation costs of KR and AGP vs dataset size, with efficiency ratio