Available online on 21.02.2019 at http://jddtonline.info

Journal of Drug Delivery and Therapeutics

Open Access to Pharmaceutical and Medical Research

Open Access Research Article

Fast Pattern Discovery in Healthcare Data Using Graphics Processors

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ABSTRACT

The mobile medical diagnosis and health monitoring system helps in managing the various chronic diseases like asthma, blood pressure and heart diseases etc. in consultation with the remotely available physicians by initiating the emergency call automatically on the physician's mobile phone and providing the on-line vital medical parameters captured by the body area sensor network of the patient. We observed that a GPU based solution can outperform a CPU based solution by more than 30% in terms of speed up, while giving same accuracy of results, divided among healthy, normal and unhealthy patients. Finally, key parameter to model our health care data likestandard deviations of {1, 0.5, 0.5}, means of {(1, 1), (0, 0), (-1,-1)} are used to study healthy persons and unhealthy patients.

Keywords: Healthcare ; GPU; EEG; PCG; datastructure

Article Info: Received 11 Jan 2019; Review Completed 19 Feb 2019; Accepted 19 Feb 2019; Available online 21 Feb 2019

Cite this article as:

Rao N, Tanweer S, Fast Pattern Discovery in Healthcare Data Using Graphics Processors , Journal of Drug Delivery and Therapeutics. 2019; 9(1-s):358-360 **DOI: http://dx.doi.org/10.22270/jddt.v9i1-s.2446**

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INTRODUCTION

Today, we are witnessing a rapid surge in amount of data growth. Data acquisition methods are also improving day-by-day. The embedded patient monitoring systems also generate huge amount of data. Therefore, one of the goals of this research is to understand how this health care related data of patients can be used to come up with better solutions. Several aspects of the developed system related to design, usability, reliability, and accuracy etc. will also be studied in actual field conditions [1-5].

SIMULATION DETAILS & RESULTS

Our algorithm runs on a CPU-GPU hybrid system. The parallel algorithm was implemented on NVIDIA GPU using CUDA-C. Not all part can be ported to GPU as discussed above. But the portion of the algorithm which can be ported is a highly compute intensive – calculation of distance. In Figure 1 we show the health care data set consisting of 16K points based on the ground truth.

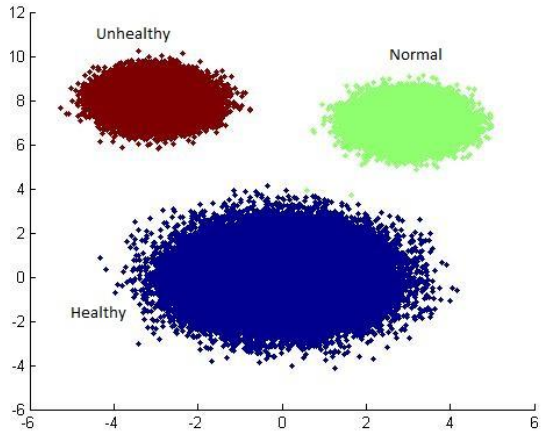
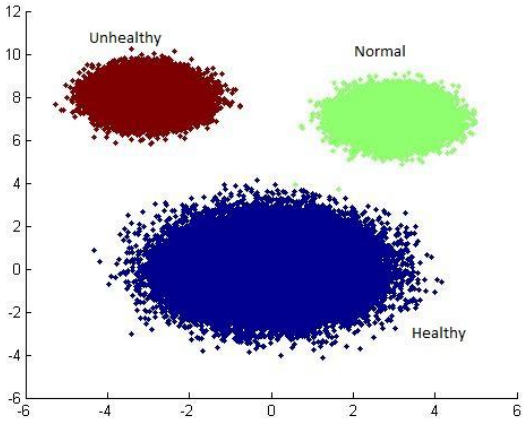


Figure 1: Healthcare data based on ground truth



The result on the GPU is shown in Fig 2:

Figure 2: Healthcare data divided among three groups on GPU

The Fig 3 shows simulation data with Normal distribution with standard deviations of {1, 0.5, 0.5}, and means of {(1,1), (3,3), (-3,3)}

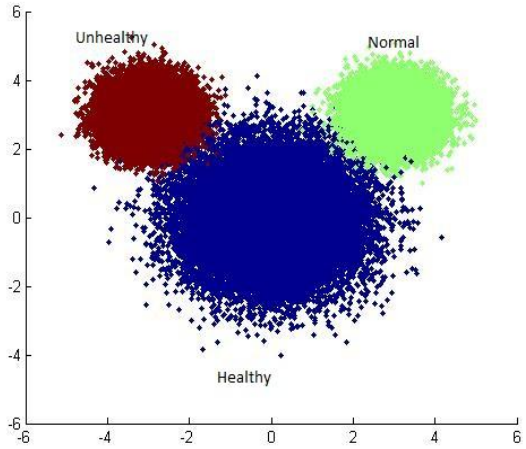


Figure 3: Initial Healthcare data

The performance on the GPU is shown in Fig. 4

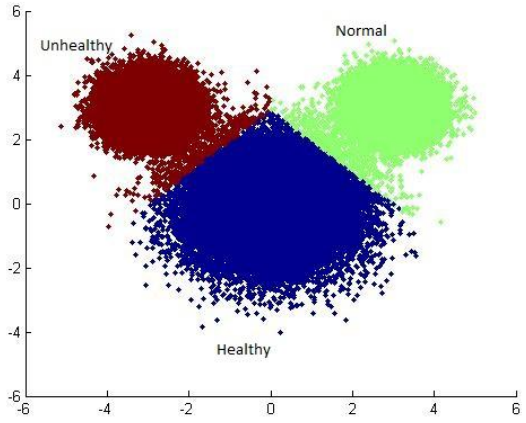


Figure 4: Healthcare data divided among three groups on GPU

In the Fig 5, the data is generated with the mean around {(1,1), (3,3), (-3,3)}.

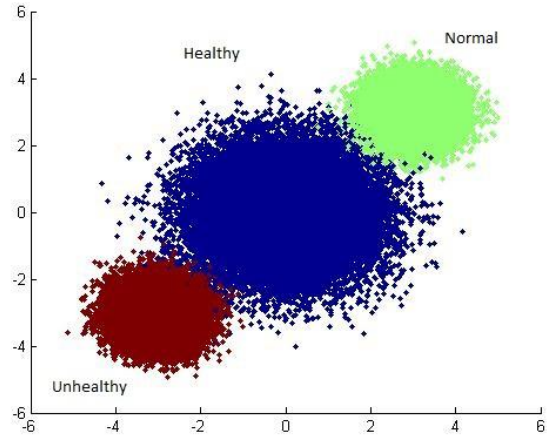


Figure 5: Initial Healthcare data

And the output of the clustering is shown in Fig 6:

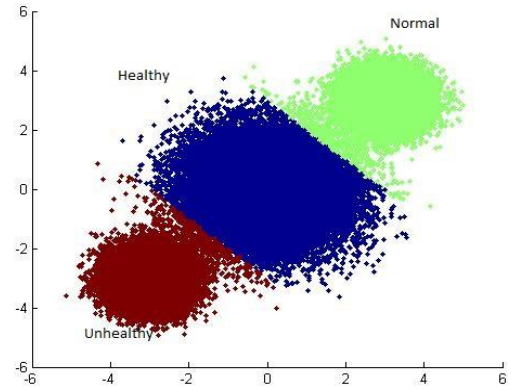


Figure 6: Healthcare data divided among three groups on GPU

Finally we used the following parameter to model our health care data:

Standard deviations of {1, 0.5, 0.5}, means of {(1,1), (0,0), (-1,-1)},which is shown in Fig 7

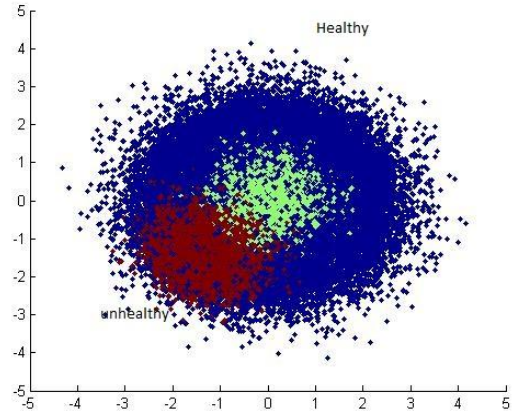


Figure 7: Initial Healthcare data

And the result of corresponding clustering is shown in Fig 8:

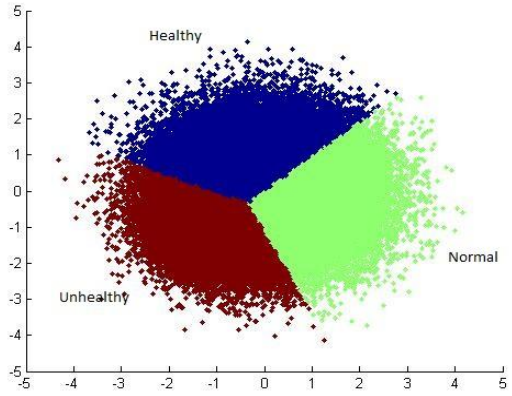


Figure 8: Initial Healthcare data divided among three different groups on GPU

For simulation purpose we generated different data set representing health care related data. The goal is to get three clusters representing Healthy, Not healthy and Normal patients In one experiment the data consisted of three classes, each normally distributed, with means of {(0,0), (3,1), (-3,1)} and standard deviations of {1, 0.5, 0.5} respectively. The clusters were initialized to values close to - but not exactly - these means, so we could compare the results to the ground truth.

CONCLUSION

We observed that a GPU based solution can outperform a CPU based solution by more than 30% in terms of speed up, while giving same accuracy of results, divided among healthy, normal and unhealthy patients. Finally, key parameter to model our health care data likestandard deviations of {1, 0.5, 0.5}, means of {(1,1), (0,0), (-1,-1)} are used to study healthy persons and unhealthy patients.

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