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BIG DATA FRAMEWORK BASED LIBRARY DEVELOPMENT FOR DISABILITY RELATED DEVELOPMENT MANAGEMENT IN HEALTH CARE

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ABSTRACT

In health care one of the major challenge is to provide assistive technology to people affected by spine injuries that calls for gadgets in various configuration, customization, features, functions, providing various values and benefits, with security, safety and reliability. This development in turn needs to satisfy volume, variety, velocity, variability and veracity thus forming a problem in big data. More over such a requirement can be formulated as a framework and needs development of libraries such that assistive technology of various gadgets can be quickly developed, customized and configured to suite a particular patients dire needs of assistance, satisfying unique requirements of a patient and related variations and varieties. Such library development is an important step in realization of assistive technology for disability related gadget development and management. In this paper one such framework is proposed and attempt made towards development of library related to assistive technology development and management. The steps involved are use of Analytical Hierarchical Process (AHP) and Geshgorin method of Eigen value development to de-entangle otherwise entangled dimensions and also to reduce the order of the system under consideration. The library thus being attempted in this paper is how to incorporate AHP and Geshgorin as library functions in big data applications especially in assistive technology for disability assistance, development and management.

Key Words: Analytical Hierarchical Process, Geshgorin Method, Big Data, Framework, Assistive Technology

I INTRODUCTION

Health care for disability management poses unique challenges in the form of demanding needs of variety, volume, velocity, variability and variety thus coming in the realm of big data development. More over in India and in the city of Delhi alone around 20,000 cases of spine injury patients are treated every year needing assistive technologies of various configurations, customizations, features, functions, values, benefits satisfying security, safety and reliability needs of the individual patients. Such needs of assistive technology can be developed into a framework and from that we can develop various libraries such that one is in a position deliver

assistive technological solutions to the patient as per demand and urgency of the solution and can further are enriched based on the variability, variety, volume, velocity and veracity encountered from time to time. Such library development will become matured over a period time so that service to such patients will happen as per demand and need in shortest possible time. In this paper such a need is developed into a frame work in big data and certain development needed to process individual cells of the framework is developed as the basic library. One such library requirements to process individual cells using Analytical Hierarchical Process (AHP) and Geshgorin method of Eigen value calculation. One particular cell is taken and the above development is demonstrated. In section 2 we explain the framework, section 3 talks about AHP and Geshgorin method, section 4 explains how AHP and Geshgorin is used to reduce order of the model pertaining to a particular cell. We can repeat this process for all cells and identify the dominant dimension to identify a particular framework that will be used in the development and management of assistive technology. In section 5 we explain the conclusion and future possible developments in this field of assistive technology.

1.1 Assistive Technology Development and Management Framework (ATDMF)

The big data attributes variety, velocity, variability, volume and veracity are considered as column and following attributes functions, features, value, benefit, customization, configuration, safety, security and reliability are considered as rows as shown below

Application / Big Data	Variety	Velocity	Variability	Volume	Veracity
Functions					
Features					
Values					
Benefits					
Customization					
Configuration					
Safety					
Security					
Reliability					

Table 1: Assistive technology development framework

In the above table each cell may have many dimensions based on the application under consideration. Hence model order reduction need to be carried out based on the figure 1.

The higher order complex model pertains to each cell of the assistive technology development framework shown in table 1. Each cell made up many dimensions and model order reduction is done through two step process.

Step1: Use AHP matrix to characterize the dimensions in the form of a matrix

Step 2: Use Geshgorin method to identify dominant dimension and reduce the order to dominant one.

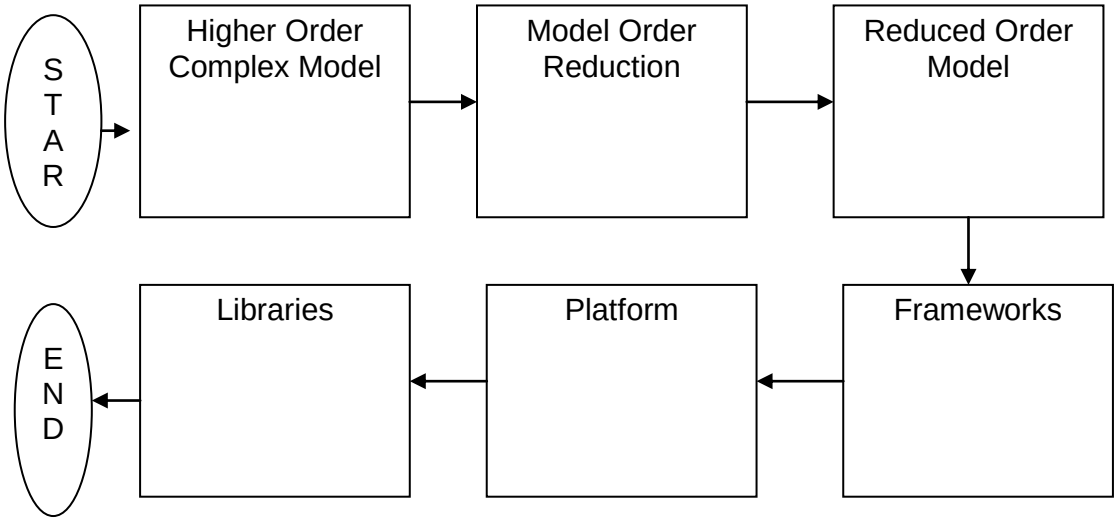


Figure 1: Methodology of model order reduction to create library to suite platform of development

Once it is carried out for all cells we have a uniform frame work and each column pertain to a particular architecture. By integrating all architectures to get a platform for development of the library needed to implement the technology targeted.

Thus AHP and Geshgorin methods become part of the system level library for developing the assistive technology and a brief of that is introduced in the next section.

II AHP AND GESHGORIN METHOD

2.1 Analytical Hierarchical Process (AHP)

When many dimensions are involved managing them to find the dominant ones and to separate them from any entanglement is a challenge in complex systems. The Analytical Hierarchical Process (AHP) is a simple tool to reduce the order of multidimensional complex systems. It offers model, visualization, and analysis of the dependencies among the entities of a complex system and arrives at ways to reduce the order of the system. The Analytical Hierarchical Process as a tool provides representation of a complex system and to capture the interactions/interdependencies/ interfaces between system elements (i.e. sub-systems and modules).

2.2 Geshgorin Method

One method of finding Eigen value of matrix and the entangled dimensions are separated through Geshgorin method of Eigen value and Eigen vector determination by applying it to the Design Structure Matrix. Thus when many dimensions are involved dominant one can be identified and also separated from any entanglement with other dimensions using Geshgorin Method.

2.3 Cell Level computation of ATDMF

From literature [7,8,9,10,11,12,13,14,15,16,17,18] the following dimensions are identified for the cell with variability and customization.

Cell	Customization			
Variability	Data Structure	service consumption	dynamic configuration	port virtualization
	Auto tuning	Instruction Set Extension	standardization	Parameterization
	flexibility	workflow automation	adaptability	standard kernels
	Standard algorithms	Standard Implementations	Variational Data structures	Intermediate Representation
	YZ Stack	Plug-in optimization	ADR data sets	visualizes
	scalable indexing	RISC-style architecture	Virtual Machine	Application Reduction

Table 2: Dimensions of variability and customization cell

Even though all dimensions look very important and need to be included it is essential to find out the dominant ones to find the point of interface and pluggable points to the platform.

For this purpose we propose AHP techniques to identify hierarchy and use Geshgorin to de-entangle them so that it can be used effectively in platform integration. These exercise need to be repeated for all cells and arrive at the point of interface, interaction and plug-ins.

The analysis using AHP results in the required 24X24 Matrix whose Eigen values are found using Geshgorin circles to identify the dominant and de-entangled ones.

A Matrix generated for our case is given below:

A = Columns 1 through 9

0.7324	5.9099	9.1019	1.9377	4.3237	7.4916	0.3918	9.4632	7.6367
5.9099	9.1019	1.9377	4.3237	7.4916	0.3918	9.4632	7.6367	5.5882
9.1019	1.9377	4.3237	7.4916	0.3918	9.4632	7.6367	5.5882	1.8384
1.9377	4.3237	7.4916	0.3918	9.4632	7.6367	5.5882	1.8384	4.9795
4.3237	7.4916	0.3918	9.4632	7.6367	5.5882	1.8384	4.9795	5.1785
7.4916	0.3918	9.4632	7.6367	5.5882	1.8384	4.9795	5.1785	9.9424
0.3918	9.4632	7.6367	5.5882	1.8384	4.9795	5.1785	9.9424	8.5485
9.4632	7.6367	5.5882	1.8384	4.9795	5.1785	9.9424	8.5485	9.6240
7.6367	5.5882	1.8384	4.9795	5.1785	9.9424	8.5485	9.6240	6.7894
5.5882	1.8384	4.9795	5.1785	9.9424	8.5485	9.6240	6.7894	4.0350
1.8384	4.9795	5.1785	9.9424	8.5485	9.6240	6.7894	4.0350	9.3498
4.9795	5.1785	9.9424	8.5485	9.6240	6.7894	4.0350	9.3498	4.7948

5.1785	9.9424	8.5485	9.6240	6.7894	4.0350	9.3498	4.7948	2.3179
9.9424	8.5485	9.6240	6.7894	4.0350	9.3498	4.7948	2.3179	3.9629
8.5485	9.6240	6.7894	4.0350	9.3498	4.7948	2.3179	3.9629	7.0508
9.6240	6.7894	4.0350	9.3498	4.7948	2.3179	3.9629	7.0508	5.5856
6.7894	4.0350	9.3498	4.7948	2.3179	3.9629	7.0508	5.5856	9.9548
4.0350	9.3498	4.7948	2.3179	3.9629	7.0508	5.5856	9.9548	9.6243
9.3498	4.7948	2.3179	3.9629	7.0508	5.5856	9.9548	9.6243	5.3507
4.7948	2.3179	3.9629	7.0508	5.5856	9.9548	9.6243	5.3507	9.6387
2.3179	3.9629	7.0508	5.5856	9.9548	9.6243	5.3507	9.6387	1.1563
3.9629	7.0508	5.5856	9.9548	9.6243	5.3507	9.6387	1.1563	0.5145
7.0508	5.5856	9.9548	9.6243	5.3507	9.6387	1.1563	0.5145	3.0435
5.5856	9.9548	9.6243	5.3507	9.6387	1.1563	0.5145	3.0435	5.8019

Columns 10 through 18

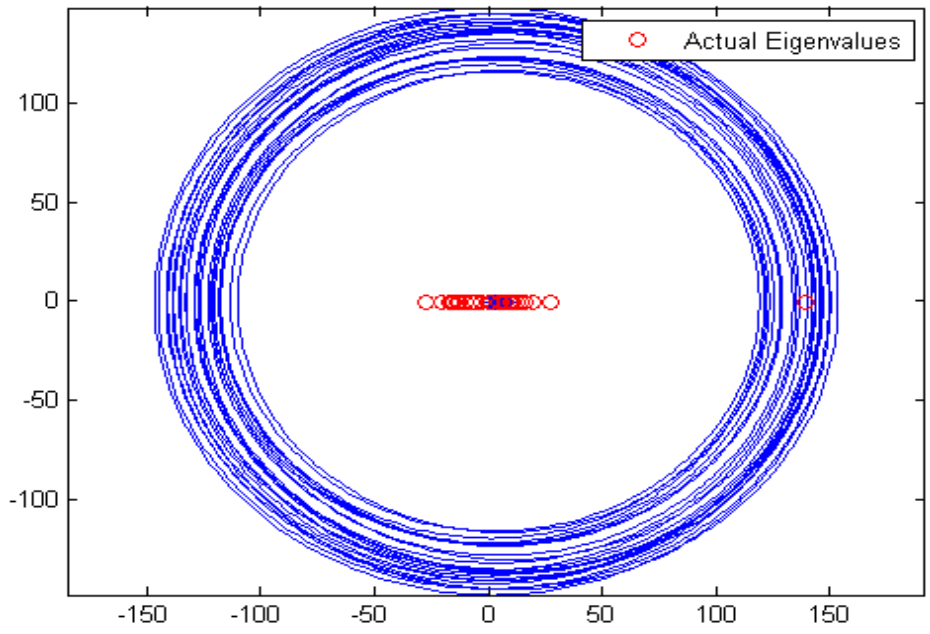
5.5882	1.8384	4.9795	5.1785	9.9424	8.5485	9.6240	6.7894	4.0350
1.8384	4.9795	5.1785	9.9424	8.5485	9.6240	6.7894	4.0350	9.3498
4.9795	5.1785	9.9424	8.5485	9.6240	6.7894	4.0350	9.3498	4.7948
5.1785	9.9424	8.5485	9.6240	6.7894	4.0350	9.3498	4.7948	2.3179
9.9424	8.5485	9.6240	6.7894	4.0350	9.3498	4.7948	2.3179	3.9629
8.5485	9.6240	6.7894	4.0350	9.3498	4.7948	2.3179	3.9629	7.0508
9.6240	6.7894	4.0350	9.3498	4.7948	2.3179	3.9629	7.0508	5.5856
6.7894	4.0350	9.3498	4.7948	2.3179	3.9629	7.0508	5.5856	9.9548
4.0350	9.3498	4.7948	2.3179	3.9629	7.0508	5.5856	9.9548	9.6243
9.3498	4.7948	2.3179	3.9629	7.0508	5.5856	9.9548	9.6243	5.3507
4.7948	2.3179	3.9629	7.0508	5.5856	9.9548	9.6243	5.3507	9.6387
2.3179	3.9629	7.0508	5.5856	9.9548	9.6243	5.3507	9.6387	1.1563
3.9629	7.0508	5.5856	9.9548	9.6243	5.3507	9.6387	1.1563	0.5145
7.0508	5.5856	9.9548	9.6243	5.3507	9.6387	1.1563	0.5145	3.0435
5.5856	9.9548	9.6243	5.3507	9.6387	1.1563	0.5145	3.0435	5.8019
9.9548	9.6243	5.3507	9.6387	1.1563	0.5145	3.0435	5.8019	5.3096
9.6243	5.3507	9.6387	1.1563	0.5145	3.0435	5.8019	5.3096	9.0121
5.3507	9.6387	1.1563	0.5145	3.0435	5.8019	5.3096	9.0121	5.4055
9.6387	1.1563	0.5145	3.0435	5.8019	5.3096	9.0121	5.4055	4.3198
1.1563	0.5145	3.0435	5.8019	5.3096	9.0121	5.4055	4.3198	5.4267
0.5145	3.0435	5.8019	5.3096	9.0121	5.4055	4.3198	5.4267	7.1241
3.0435	5.8019	5.3096	9.0121	5.4055	4.3198	5.4267	7.1241	0.1667
5.8019	5.3096	9.0121	5.4055	4.3198	5.4267	7.1241	0.1667	8.0092
5.3096	9.0121	5.4055	4.3198	5.4267	7.1241	0.1667	8.0092	1.4251

Columns 19 through 24

9.3498	4.7948	2.3179	3.9629	7.0508	5.5856
4.7948	2.3179	3.9629	7.0508	5.5856	9.9548
2.3179	3.9629	7.0508	5.5856	9.9548	9.6243
3.9629	7.0508	5.5856	9.9548	9.6243	5.3507
7.0508	5.5856	9.9548	9.6243	5.3507	9.6387
5.5856	9.9548	9.6243	5.3507	9.6387	1.1563

9.9548	9.6243	5.3507	9.6387	1.1563	0.5145
9.6243	5.3507	9.6387	1.1563	0.5145	3.0435
5.3507	9.6387	1.1563	0.5145	3.0435	5.8019
9.6387	1.1563	0.5145	3.0435	5.8019	5.3096
1.1563	0.5145	3.0435	5.8019	5.3096	9.0121
0.5145	3.0435	5.8019	5.3096	9.0121	5.4055
3.0435	5.8019	5.3096	9.0121	5.4055	4.3198
5.8019	5.3096	9.0121	5.4055	4.3198	5.4267
5.3096	9.0121	5.4055	4.3198	5.4267	7.1241
9.0121	5.4055	4.3198	5.4267	7.1241	0.1667
5.4055	4.3198	5.4267	7.1241	0.1667	8.0092
4.3198	5.4267	7.1241	0.1667	8.0092	1.4251
5.4267	7.1241	0.1667	8.0092	1.4251	4.7847
7.1241	0.1667	8.0092	1.4251	4.7847	2.5684
0.1667	8.0092	1.4251	4.7847	2.5684	3.6909
8.0092	1.4251	4.7847	2.5684	3.6909	6.6176
1.4251	4.7847	2.5684	3.6909	6.6176	1.6961
4.7847	2.5684	3.6909	6.6176	1.6961	2.7878

Results of Geshgorin circles are as shown below



For this cell it was found data structure and Variational data structures to be two dominant dimensions that cannot be further simplified.

III CONCLUSION AND FUTURE WORK

It was proved how AHP and Geshgorin library functions help in system level to identify the dominant dimensions as well as decouple them so that it can be efficiently used in the platform integration in an application of big data for disability management for implementation of assistive technology. Thus it is the first cell processing need to be carried out each cell of ATDMF framework and forms the system level library function in such big data application processing. As part of future research effort all cell processing will be carried out for disability management and assistive technology implementation. Row wise and column wise architectures as well as different frameworks that constitute the platform which in turn will help us to identify a generic library will be carried out and such library will help in developing assistive technology implementation to manage various levels of disability across various products.

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