International Journal of Enhanced Research in Science, Technology & Engineering
ISSN: 2319-7463, Vol. 5 Issue 4, April-2016

Inferences using Knowledge Base and Cognitive Intelligence

Ms Vandana M (SRS), Mr Sunil Sharma M (RS), Mr Devesh Mishra M (RS),
Ms Bhawana Sharma M (RS)

ABSTRACT

The paper presents, optimizes and analyzes the performance of an expert system with inference engine using knowledge base. A comparison has been done with various knowledge based approaches before adopting the rule based approach and selecting the approach for optimization. The Optimization of generating inferences has been done based on number of parameters for filtering and cognition which includes area divided into zones, attributes of the lower and higher level entities, human intervention and learning by the system. Optimum values for important parameters have been calculated for actual data throughput.

1.0 INTRODUCTION

Defence and medical applications require artificial intelligence to draw inferences. There are many challenges and approaches available to develop these systems. The approaches include analysis of scanned images, scanned newspaper information, voice interpretation and email. Challenges include extraction and interpretation of the relevant information, information overload, irrelevant and past data. Section II of the paper presents concept of knowledge base approach for solving the problem using cognitive intelligence elucidated in section III. Architecture of inference engine has been provided in section IV with prototyping and performance optimization in subsequent sections.

II. KNOWLEDGE BASE

Artificial intelligence requires representation of knowledge for reasoning. In tactical scenario it includes determination of enemy units and identification of activities posed by the enemy. Depending on the various parameters rule information is maintained in the system with approaches to apply First applicable rule, most complex rule and least recently used rule. The rules may be represented as IF AND THEN, WHEN THEN WHERE. Semantic networks which represent hierarchical relationships is another method to represent knowledge. Analogy is a direct method to represent knowledge about some aspects.

III. COGNITIVE INTELLIGENCE

This includes multiple phases with first phase beginning by developing a model using existing rules and historical data. The sample reasoning trees so obtained from first phase are used to obtain system specification. Lastly the system is made to learn and refine reasoning rules. Fig 1 shows the reasoning steps. A model which can be built may comprise of the following hypothesis

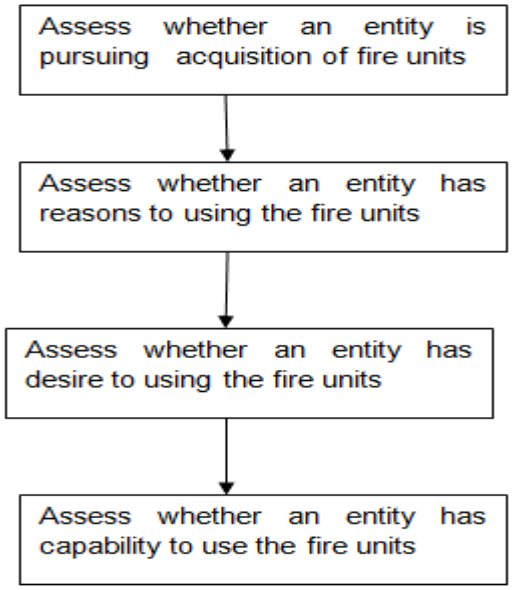


Fig 1 Reasoning Steps

Based on the various questions formulated above, answers can be derived, relationships between various parameters drawn and conclusions generated which in turn may be used to learn a new rule or generate a new rule and stored in knowledge base.

IV. ARCHITECTURE OF THE INFERENCE ENGINE

The modelling of inference process is as given in fig 2.Inputs from sources and sensors result in lower level entity generation. Lower level entities combine to form higher level entities. The knowledge base and lower as well as higher level entities are subject to inference process. During the process there may be contradictions which are displayed to the operator. The operator resolves these contradictions which go through the inference process again and are displayed to the operator. The states generated during the inference process are stored and also the finally generated events.

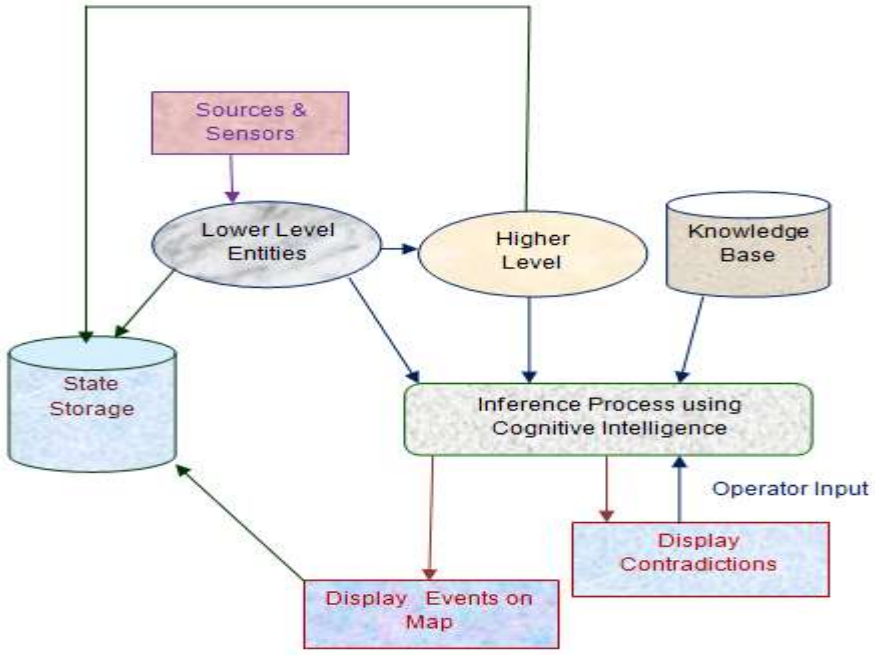


Fig 2 Inference Process

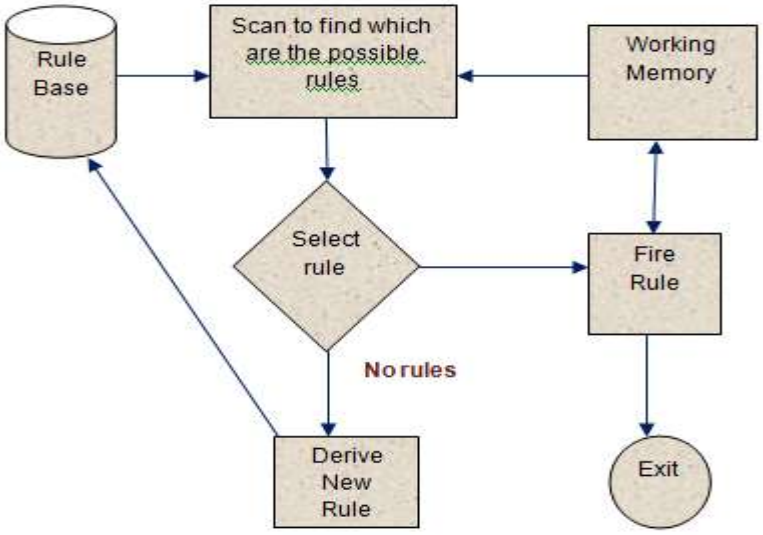


Fig 3 State Generation

Inference process using cognitive intelligence results in generation of states which are maintained by the system. Fig 3 indicates the flowchart whereby the rules are read from the rule base and the working memory. Based on the inputs received all the rules are scanned and some of the rules which are selected for firing and are placed into the working memory for faster access. In case no rule satisfies after the scanning process on performing the reasoning steps a model is built and new rules are generated which are fed into the rule base and get included as knowledge base. On firing the rule, the working memory is cleared and process repeated with updation in inputs or periodically to suit the frequency of reception.

V. SNAPSHOT OF THE PROTOTYPED APPLICATION

Fig 4 displays the snapshot of generated events displayed on the tiff image with source and sensor displayed. The various entities detected like vehicle, gun and tank which have been detected and processed have been displayed. Based on the inference process Concentration area and concentration area of artillery and troop seen of enemy have been derived and displayed. Depending on the entities that have been detected, knowledge base and reasoning the following snapshot has been derived for an area chosen. The area of concern has been marked by a rectangle.

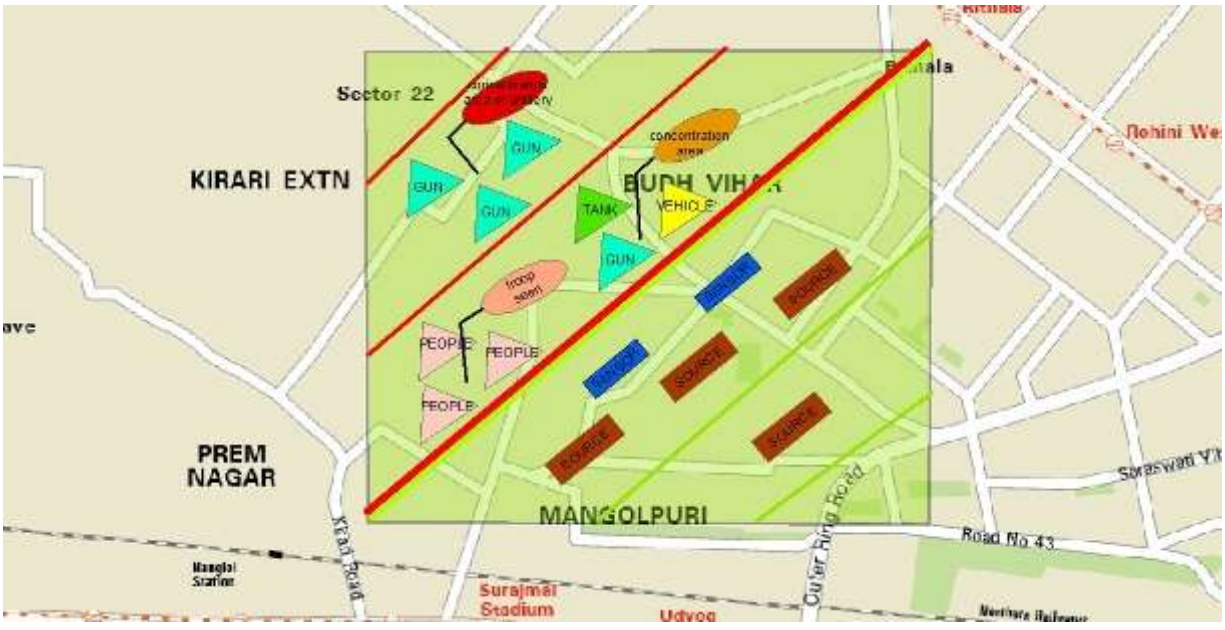
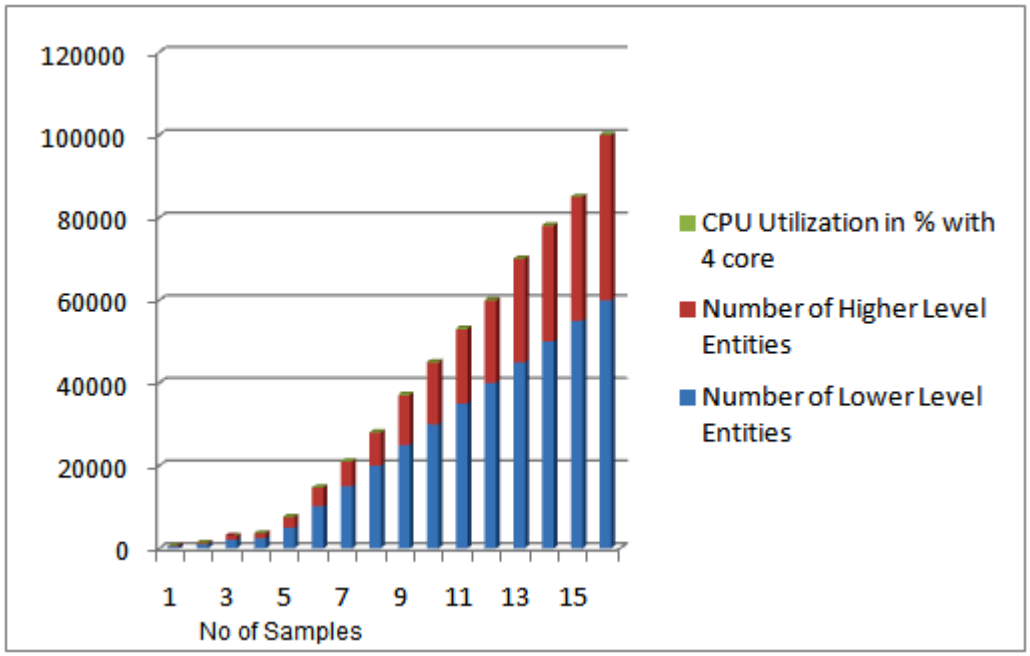


Fig 4 Generated Events

VI. OPTIMIZATION OF INFERENCE ENGINE

The resource utilization in terms of processor and memory for various values of entities generated were collected and have been depicted in Fig 5.Upto sixteen samples were collected as indicated in x axis and number of entities generated on y axis. The processor used for execution was quad core with 4 GB memory. Once the entities were generated, it was seen that the event generation took more time. This was optimized by using a better data structure, filtering mechanisms were laid down to reduce number of entities to be checked and working memory entries were also reduced thereby reducing the generation of output to less than a second and providing a real time picture.



CONCLUSION

From the results obtained one can conclude that the proposed architecture can refine using knowledge base thereby enabling inferences in real time.

ACKNOWLEDGEMENT

The authors would like to thank the seniors for their valuable inputs, in particular Mr Ranjan Banerjee Chief Scientist, Mr Anoop Kumar Rai Principal Scientist and Mr Kanishka Sarkar.

REFERENCES

[1]. Object Oriented Artificial Intelligence using C++ by Kim W Tracy, Peter Bouthoorn Computer Science Press.
[2]. Mathematical Techniques in MultiSensor Data Fusion David L Hall, Sonya A.H McMullen Artec House Publishers.
[3]. MultiSensor Data Fusion Martin E Liggins, David L Hall, James Llinas CRC Press.