

Role of Pattern Recognition and Data Analytics in Medical Sciences for Caring People with Alzheimer's (Dementia)

Dr. M Srinivasa Rao
PTO
C-DAC, Pune

Abstract - The idea is to build a system to diagnose behavioural dementia and provide follow up care. System would analyze symptoms and behaviour of a patient in order to generate patterns; which eventually helps in decision making through pattern recognition and data analytics. As such kind of hand-held (Mobile, bracelet) and interactive computer applications are not existed in Indian context, therefore it is worth to develop a system to assist patients, carers and doctors with dementia related information, resources, care giver tips, patient tracking and alert system, blog, report generation and many more features. As a matter of fact, in India annually more than 4 million people effecting with Dementia, of this majority are those residing in rural areas. The proposed system would assure a readily available expertise medical advice and care to the general masses residing in the rural/remote and urban areas, where quality medical professionals are not readily available in adequate numbers. The proposed system is envisaged to both compliment as well as supplement the medical expertise available at ground level.

keywords - Pattern Recognition, Data Analytics, Caring people with Dementia (PwD)

- About Dementia:** Alzheimer's disease is the most common type of dementia. Dementia is a collective name for progressive degenerative brain syndromes which affect memory, thinking, behaviour and emotion. Symptoms may include:
 - Loss of memory
 - Difficulty in finding the right words or understanding what people are saying
 - Difficulty in performing previously routine tasks
 - Personality and mood changes
- Diagnosis:** A reasonably accurate diagnosis of dementia can be made by taking a careful history of the person's problem from a close relative or friend, together with an examination of the person's physical and mental status. There is, however, no simple test to make a diagnosis. An early diagnosis is helpful, because it enables caregivers to be better equipped to cope with the disease progression provides people with dementia with an opportunity to make decisions before they lose the ability to do. So giving follow up care to dementia people is a better chance to benefit them along with existing treatments.
- Introduction:** In the present day scenario, with the exponential increase in the population and scarcity of doctor's, medical diagnosis and medical care has become challenging task in medical science. In India Dementia behaviour is often mistaken as old age. Families and caregivers do not know how to help such patients. They are unaware of care giving skills or other support and resources they can use.

As pre the Dementia India report 2010 of Alzheimer's and Related Disorders Society of India (ARDSI), there are more than 3.7 million people nationally and 30+ million people internationally are affected in Yr. 2010. It is expected to be doubled by 2030. Estimated cost of taking care of a person with dementia is about Rs 43,000 per annum and the total societal cost is about Rs 14,700 Crores per annum as per dementia India report 2010. Chronic diseases leaving disabilities every year; dementia is having major contribution with 11.9% which is much higher than strokes, heart diseases, arthritis and many more. In view of this, it becomes important that a solution must be conceived of so that it may reach the general masses and assist them in a timely fashion by providing expert medical relief.

Dementia – Steep increase in numbers

Number of People with Dementia in India (in millions) (Source: ARDSI 2018)

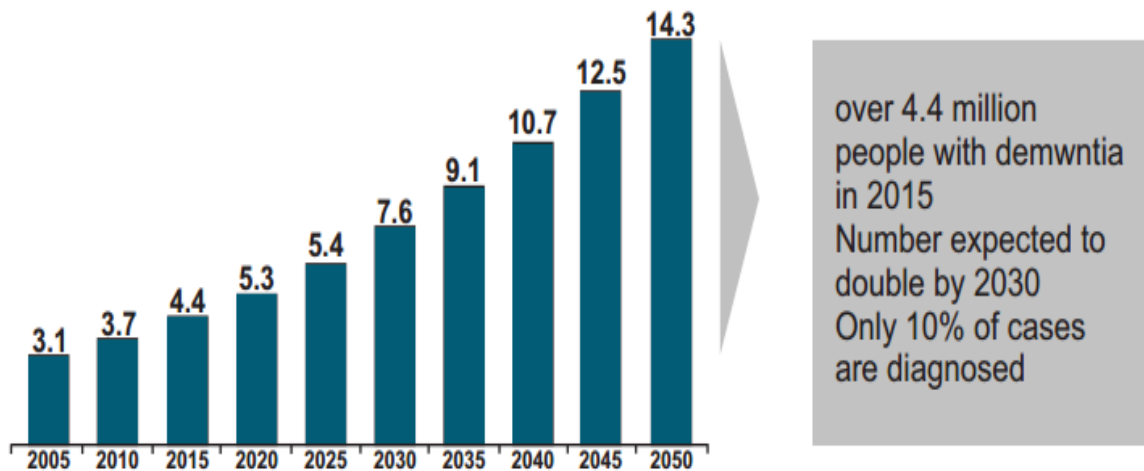


Fig.1 Number of people with Dementia in India

4. Problem Definition and Introduction to Proposed System: The idea is to build a system to diagnose behavioural dementia and provide follow up care. System would analyze symptoms and behaviour of a patient in order to generate patterns; which eventually helps in decision making through pattern recognition and data analytics. As such kind of hand-held (Mobile, bracelet) and interactive computer applications are not existed in Indian context, therefore it is worth to develop a system to assist patients, carers and doctors with dementia related information, resources, care giver tips, patient tracking and alert system, blog, report generation and many more features.

Proposed system provides information on activities, interactive games, carer tips and patient monitoring, tracking and emergency alerts. The system is to be developed in modular form in four stages:

1. Pattern generation and decision making engine
2. Mobile application to assist carers
3. Hand-held device and
4. Web application

4.1 Detailed work flow of the proposed system:

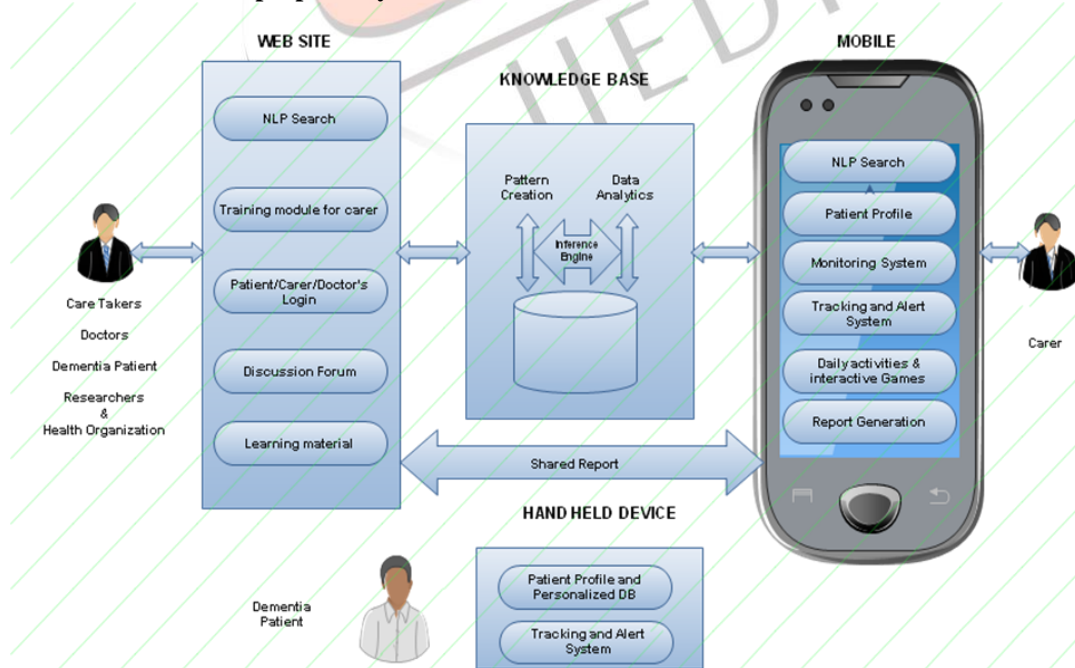


Fig.2 Work flow of Proposed System

4.2 System design for pattern recognition, machine learning and decision making:

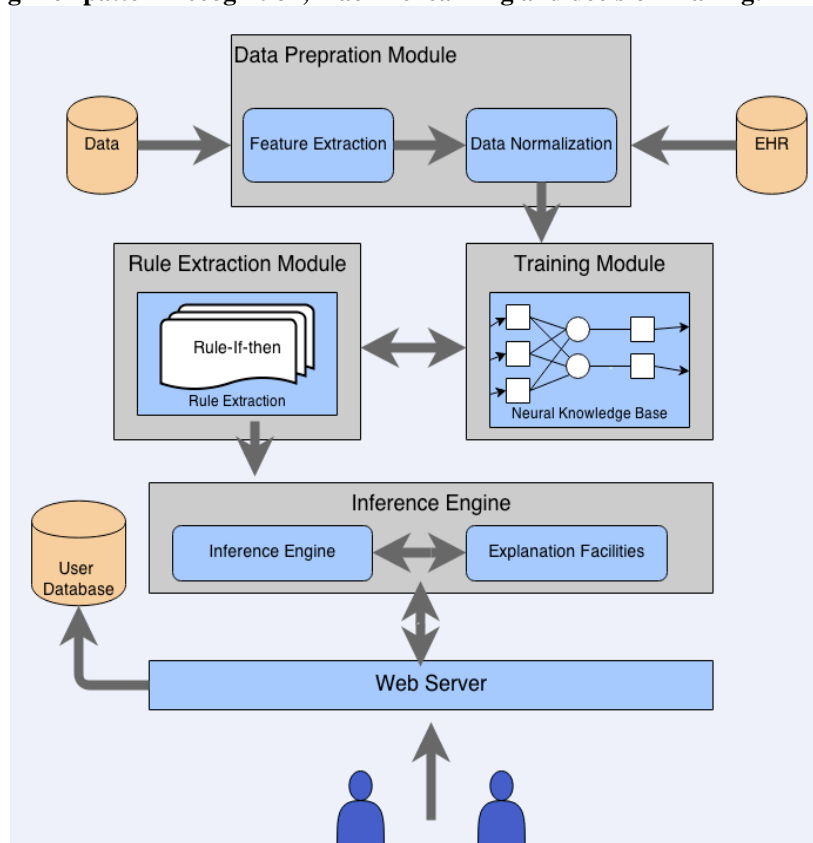


Fig.3 Architecture of proposed system

5. Existing National and International scenarios prevailing in the proposed area:

A. National Scenario (Few Examples):

- Dementia Care Notes
- Alzheimer's and related disorders society of India – ARDSI (www.alzheimer.org.in)

B. International Scenario (Few Examples):

- Carer app for iPhone – www.Mirror-project.eu
- Digital Life History App – http://my.lifesoftware.com
- Digital Reminiscence Therapy Software By My Life Software
- DEM@CARE BY IBM
- www.cogknow.eu
- Dementia collaborative research center, Australia
- Dementia research group, world health organization (WHO)

6. **Current Scenario of various Tools/Standards available at National and International Level:** No specific standards as such exist in the general domain concern to Dementia care. However for evaluating the system the proposer shall come up with proprietary standards and approvals (if required).

7. **Requirement Specification (Various Components and Modules):** The whole process can be divided into the following modules, viz.,

- Data / Corpus collection module
- Pattern Recognition and Decision making module:
 - Creation of patterns
 - Rule extraction module
 - Machine learning module
 - Inference Engine for decision
- Patient profile system
- Voice & non voice based NLP query system
- Patient tracking and alert system
- Incorporation of daily living activities and interactive games
- Discussion forum
- Carer training module

- Report generation module

8. Summary: In the context of a developing nation such as India, in the present day scenario, making medical care readily available to the general masses, residing mostly in the rural areas, to prevent the severity and mortality due to Dementia disease most commonly occurring in the country's topography, is one of the biggest development challenges. As a matter of fact, in India annually more than 4 million people effected with Dementia, of this majority are those residing in rural areas. The proposed system would assure a readily available expertise medical advice and care to the general masses residing in the rural/remote and urban areas, where quality medical professionals are not readily available in adequate numbers. The proposed system is envisaged to both compliment as well as supplement the medical expertise available at ground level.

The stated below is one of the "recommendations of Dementia India report 2010 of Alzheimer's and Related Disorders Society of India (ARDSI)", which depicts the need, necessity and vacuum for developing tools and models in order to provide care to People with Dementia (PwD) at their own homes.

"Develop comprehensive dementia care models: Develop an integrated, comprehensive range of care models for PwD to bridge the gap between care at home and care in a care home. The direction of the health and social care policy should be to increase the proportion of older people who can be supported in their own homes in the community. Nevertheless there will be some need to have long-term care for PwD without families and for those who have complex medical conditions. Many of the elders in old age homes have some form of dementia. More effort is required from the public, private and voluntary sector to find good quality, cost effective options to meet the needs of PwD and their families".

9. References

- [1] WHO (2017) WHO Global Action Plan on the public health response to dementia 2017-2025.
- [2] Alzheimer's and Related Disorders Society of India - The Dementia India Report 2010.
- [3] Abbatecola A. M., Paolisso G., Lamponi M., Bandinelli S., Lauretani F., Launer L., Ferrucci, L. (2004), Insulin Resistance and
- [4] Executive Dysfunction in Older Persons. Journal of the American Geriatrics Society, 52, 1713–1718. doi: 10.1111/j.1532-5415.2004.52466
- [5] ADAPT Research Group.(2006)Cardiovascular and cerebrovascular events in the randomized, controlled Alzheimer's Disease Anti-Inflammatory Prevention Trial (ADAPT). PLoS Clin Trials,1(7):e33.
- [6] Allegri R.F., Butman J., Arizaga R.L., Machnicki G., Serrano C., Taragano F.E. (2007) Economic impact of dementia in developing countries: an evaluation of costs of Alzheimer-type dementia in Argentina. International Psychogeriatrics, 19(4), 705-718.
- [7] www. Mirror-project.eu
- [8] http://my lifesoftware.com
- [9] www.cogknow.eu
- [10] Alzheimer Europe (2009) Dementia in Europe Year book 2008; Alzheimer Europe (Project: EuroCoDe 2003-2008). Luxembourg: Alzheimer Europe. page,179 .
- [11] Alzheimer's Association (2009), 2009 Alzheimer's disease Facts and Figures USA: Alzheimer's Association. http://www.alz.org