Review Article

Health and Medical Informatics and Allied Health Focused Domains: An Analytical Study related to the Emerging Interdisciplinary Research

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ABSTRACT

Health Informatics is an important and valuable domain responsible for the information systems designing and development. The domain is interdisciplinary in nature and fall under the Biological Information Sciences. Among the emerging Biological Information Sciences few important are include the Nursing Informatics, Dental Informatics, Bio Informatics, Clinical Informatics, Pharmaceutical Informatics, Nutritional, Neuro Informatics etc. More importantly these Informatics domains are actively engaged in the better information infrastructure building with the help of tools and technologies. Each and every Informatics is responsible for the information transfer cycle in their respective fields. The Informatics becomes an interdisciplinary fields and application oriented. The application and area of utilization are increasing rapidly. Interestingly among the Pure Information Science and Bio Information Science, the Biological areas are increased with huge numbers. It is a fact that still theoretical works combining all these Health Informatics related domains are very much limited.

The paper is based on conceptual overview and deals with the related aspects of Health Informatics including the basic overview, agendas and emerging functions etc.
INTRODUCTION

Informatics is a domain of interdisciplinary in nature and responsible for information activities ranging from the collection, selection, organization, processing, management and dissemination. For doing the job, the Informatics basically takes the help of computing and Information Technologies such as Database, Networking, Web, Multimedia etc [05], [08], [21]. The Informatics is an Applied Science domain and combinations of Informatics with other domains have been created other domains and academic branches. The Health Informatics is one of the important and valuable Informatics field and dedicated to the Health and Medical related domains. The research and development in the field of Health Informatics resulted many other allied and sub fields such as Clinical Informatics, Dental Informatics, Nursing Informatics, Pharma Informatics and so on (Refer Fig: 1). Previously all these domains were managed by the Health Informatics alone. But the advancement in R&D has created these domains [02], [03], [22]. However most of these domains are practicing in nature and not yet fully developed as academic branches. The smaller to larger domain in respect to the Medical Information Science is depicted in the Fig: 2.

OBJECTIVE

This is a conceptual work related to the Informatics and its sub fields related to the Biological Sciences. The main and core agenda of this paper is includes but not limited to the following—

To know basic about the Informatics and its domains and dimensions with characteristics and features.

To draw the Health Informatics as a domain of interdisciplinary Health Science and Information Sciences.

Fig: 1 depicted the Health Information Systems and Related areas with supported systems for the ultimate aim and agenda

To learn about the related branches of Health & Medical Informatics, Bio Information Sciences with its basic information, characteristics, features etc.
To dig out brief on Clinical Informatics, Dental Informatics, Pharma Informatics, Neuro Informatics, Nutritional Informatics and other branches of Core Information Sciences focused with the medicine and health domain. To know about the Informatics with other allied areas of medicine and health but fall under the Bio Sciences i.e. Environmental Informatics, Bio Informatics. To learn about the challenges and issues related to the Core Health Informatics and its allied and pure braches.

### HEALTH INFORMATICS AND ALLIED BRANCHES

Informatics is a study and practicing domain responsible for information designing and development and building a truly sophisticated information infrastructure. Informatics and Information Science—both are same in many contexts. The term Informatics earlier was mainly popular in the European Countries where as Information Science in the United States and other follower countries [01], [04], [23].

The Informatics or Information Science has the ability to integrate or merge with other domains like Health Science and Informatics prepared Heath Informatics. Similarly other domains have created like Clinical Informatics, Pharma Informatics, Neuro Informatics, Dental Informatics and so on (See Fig: 1 for more clarification). All of these domains are dedicated to boost the solid healthcare systems and medical information infrastructure building [08], [22]. The Informatics is growing and enhancing more interdisciplinary nature in the academic research and development.

<table>
<thead>
<tr>
<th>Health Informatics</th>
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<td>Clinical Informatics</td>
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<td>Pharma Informatics</td>
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<tr>
<td>Dental Informatics</td>
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<td>Neuro Informatics</td>
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*Fig: 2-The Health Informatics and its related smallest Branches*

### HEALTH INFORMATICS

Health Informatics is the principal knowledge and subject domain in the intersection of the sciences such as Information Science and Health Related Sciences. The Health Informatics and related branches are multidisciplinary in nature and strategically depends on the domain of the computing, information technology including the information science for improved health information practices [06], [07], [22]. According to the National Library of Medicine (NLM), US the Health Informatics domain as “the interdisciplinary study of the design, development, adoption and application of IT based innovations in the healthcare service delivery, management and planning” *(Source—Wikipedia)* [37].

The Domain of Health Informatics is also called as the Health Information Science and Medical Information Science. It is also called as Medical Informatics. However among the Health Informatics related branches such as Medical Information
Science Health IT, Clinical Informatics etc, the Health Informatics and Health Information Systems is most common and popular one. Among the tools and devices of the Health Informatics popular are computers and knowledge management tools and some common managerial tools such as clinical guidelines, medical terminological guidelines, ICT Systems [06],[07], [26]. The Health Informatics is required in the following areas and sectors and professions (see Table: I)—

<table>
<thead>
<tr>
<th>Areas where Health Informatics is applied</th>
<th>Clinical Medicine</th>
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<tbody>
<tr>
<td>Nursing</td>
<td></td>
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<tr>
<td>Dentistry</td>
<td>Pharmacy</td>
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<tr>
<td>Public Health</td>
<td>Occupational Therapy</td>
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<tr>
<td>Bio &amp; Alternative Medicine</td>
<td>Bio Medical Research</td>
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*Table: 1-Depicted the related areas where Health Informatics may be applied*

### BIO INFORMATICS

The Bio Informatics is actually an interaction and intersection of the Bio Sciences and Informatics or Information Sciences. The Bio Informatics is kind of interdisciplinary knowledge cluster combines with the mathematics and statistics, computing and information technologies, engineering sciences related to the designing and development and real analysis [09], [10], [25]. Bio Informatics, these days is very much important and valuable in the biological sciences specially in the molecular biology and some of the core aim are include—

It allows and improves the healthy and smarter data and content of the images including the processing of the signals.

Bio Informatics plays a valuable role in the text mining of the Bio Sciences literature and research materials. The development of the Bio Sciences such as upgrading the Biological Ontology such as gene ontology.

It also helps in analysis of the biological networks which are important in the emerging systems biology [11], [12], [27].

The Bio Informatics also helps in the biodiversity including its modeling and similar of protein structure and mainly the DNA and RNA. In molecular interactions too the Bio Informatics attention is important and urgent.

The Bio Informatics also helps in interdisciplinary matters and research of the biochemistry, genetics, cell biology, enzymology, genetics, molecular biology, plant pathology, structural biology etc [13], [14], [28].

The major research efforts in the Bio Informatics are includes analysis of the mutation in cancer and oncogenomics, analysis of the regulation etc.

The domain of Bio Informatics ultimately helps in the following (*Table: 2*) research and development aspects of the bio sciences.

<table>
<thead>
<tr>
<th>The R&amp;D areas of Bio Informatics in Bio Sciences</th>
<th>Genome Assembly</th>
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<tbody>
<tr>
<td>Sequence Alignment</td>
<td>Drug Designing</td>
</tr>
<tr>
<td>Game Finding</td>
<td>Drug Discovery</td>
</tr>
<tr>
<td>Protein Structure</td>
<td>Cell Division</td>
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*Table: 2- Shows the possible R&D areas of Bio Informatics*

Bio Informatics is mainly supported by the technologies software technologies, web technologies, data technologies, networking technologies, multimedia technologies etc [15], [20], [24]. All these depicted Informatics are fall under the Bio and Medical domain and details are depicted in the Fig: 3.

### CLINICAL INFORMATICS
Clinical Informatics is actually the study and research of information technologies into the clinical systems as well as in allied healthcare. The domain is treated as practicing domain and close with the Medical and Health Informatics. According to the experts, Clinical Informatics basically utilizes information and content in the establishments and settings related to the clinics and medical centers etc. the Clinical Informatics is popular among the clinical professionals and also information professionals [16], [17], [26]. The study of analyzing, designing, implementing including evaluation of the contents and information which used and enhanced for the clinical settings is fall under the activities of the Clinical Informatics. Importantly the Clinical Informatics play a lead role in the following—
Evaluate and assessment of the information and other matters including their requirements among the healthcare professionals and in the common people.
Development, implementation and also improvement in the decision making and decision support systems among the clinical professionals [18], [19], [23].
Healthy and solid participation of the sophisticated clinical information systems. Clinical Informatics or Clinical Information Science is possible to apply in the wide range of healthcare establishments including medical and dental. The Clinical Informatics is also depends on some of the techniques of the knowledge organization and mostly computing technologies.

The Clinical Informatics experts basically engaged in the design and development phase of the clinical IT and technologies; they also involve in the exiting information systems. The Clinical Informatics related ordinance etc have passed in many countries and among them USA is important.

**NURSING INFORMATICS**

Nursing Informatics is an important integration and application of the nursing systems and field with computing and technologies for better nursing practice. According to the American Nurse Association, this field is helps to serve the integration of data, information as well as the knowledge support for the better and healthy decision support systems. This system will help in better patient and their providers. Nurses in this position are able and learn how to store as well as provide healthy information for enhanced medical systems to the patient and physician. It is important fact that Nursing Informatics is treated as a practicing domain rather than an academic domain [29], [33].

**PHARMACY INFORMATICS**

Pharmacy Informatics is the application and integration of ICT, Information Management tools in the pharmacy and allied domains. The Nursing Informatics is widely gains popularity in the pharmaceutical firms and drug and chemical organizations etc. The database technologies, web technologies, networking technologies, communication systems etc have played a vital role for solid development of pharmaceutical systems. The Pharmacy Informatics also uses the manual tool for content and information management. Among the tools the documentation systems, knowledge organizations are key mover. The Pharmacy Informatics important for the pharma institutes, academicians, teachers and researchers. The dentist and medical professionals may also get the benefits from the systems [30], [34].

**NUTRITIONAL INFORMATICS**

Nutritional Information Systems designing and development are the main task of the Nutritional Informatics. The Nutritional Informatics and Nutritional Information Systems many ways deemed as equivalent. Several tools and technologies normally employed in the Nutritional Informatics process. The Nutritional Informatics is also called as Food Information Systems, Food Information Systems too. The Nutritional Informatics is strongly dedicated to the string, organizing and also retrieval of the Nutritional Informatics depending upon need. The Nutritional Informatics is helpful to the following communities more specifically—
Nutritionist.
Dietician Experts.
Dental Practitioner.
Medical Practitioner.

Moreover the Nutritional Informatics is also helpful to the common man and overall improvement of the clinical nutritional information systems development and modernizations.

**DENTAL INFORMATICS**

The Informatics and its combination with the Dental Sciences bring a field called Dental Informatics. Practically the inclusion of the Information and Communication Technologies in the Dental Sciences and practices results the Dental Informatics. However the domain is in gradual stage and emerging rapidly. It is a fact that the domain is still deemed as a theoretical branch but it has the potentially to offer as a branch of interdisciplinary applied sciences. In the domain several areas of Computing, Information Science, Management Sciences along with Dental Science (with the gradients from the Medical & Pharma Sciences) are responsible and most important. The Dental Informatics is the domain dedicated to the better dental practice and overall development of the dental science education and research. The concept of Dental 2.0 is a part of the Dental Informatics. Interestingly the Dental Informatics is also helpful for the common...
people for availing betterment of common users to get the information and contents in the field of Dentistry and Allied Sciences [31], [35].

**NUERO INFORMATICS**

Nuero Informatics is the interdisciplinary knowledge cluster and also the intersection of the Nero Sciences along with the Information Science or Informatics. The field of Nuero Informatics is basically a simple and interdisciplinary domain of practicing nature. The Nuero Informatics is mainly responsible for other domain focused informatics such as collecting, selecting, organizing and processing with dissemination of the information and contents related to the Nero Science Neurology and Allied Medical and Pharma Sciences. There are several importance brings the Nuero Informatics from a practicing field to a knowledge fields. Actually the Nuero Informatics is responsible for the processing of the large amount of data and information. The related and allied branches of the Nuero Informatics are Nuero Sciences, Nuero Ethology, Brain Simulation and other areas. The main aim and objective of the Nuero Informatics are include but not limited to the—

To develop the tools including the databases for the proper management and also distribution of the data and also content in the field of Nuero Sciences.
To design and develop the complex, intelligent Nuero Science tools and products and also enhanced objects related to the Nuero Sciences.
To develop and help in the current and future area of research in the domain of brain science and nuero sciences.

**ENVIRONMENTAL INFORMATICS**

Environmental Informatics is the combination of the Environment Science and Information Science. The domain is also called as Eco Informatics. The Environmental Informatics is responsible for the improved environmental systems with the support from information related to the domain and application of the emerging technologies in the areas of environment [32], [36]. Moreover the Environmental Informatics is also considered as Green Informatics. The domain is responsible for the following activities—

- Biodiversity Informatics.
- Taxonomic Information.
- Biographic Information.
- Ecological Information etc.

The practicing aspects of Environmental Informatics are old but the nomenclatures are new due to emergence of academic and societal research.

**FINDINGS**

The Informatics domain is interdisciplinary in nature and combines with the Computer Sciences and Information Studies. The domain has the ability to merge with other domain for information systems activities of the concerned domain.

Informatics is also called as Information Science and dedicated to the Information Infrastructure building with the emerging technologies such as Cloud Computing, Green Computing, Human Computer Interaction and some other related and allied branches.

The newly emerged Informatics domains are less available in the academic wings but most popular in the practicing sectors.

Informatics as a field is very much limited in the developing countries specially in the South East Asia, African Countries and this resulted the disparities of improved healthcare services too.
SUGGESTIONS AND RECOMMENDATION

Informatics need to offer as an academic programs and departments of the allied braches such as Computer Science, Information Technologies, Communication Engineering, Management Sciences etc for improved information infrastructure building and developed. The Governments, and authorities need to take proper steps for the development of Health Informatics and allied domains. The more practice will result the development of improved health systems. Universities, Colleges, Institutes including the Research & Development Centers need to design and develop programs related to the Health and Informatics. More interdisciplinary works are also welcome.

CONCLUSION

The development of Health is many ways depends on solid and healthy implementation of the Health and Medical Informatics implementation. Importantly the branches of Informatics are rising day by day and mainly in the Bio and Medical Sciences. In many countries, Government and Institutions are putting efforts for solid development of Health Informatics. The related areas such as Dental Informatics, Pharma Informatics, Neuro Informatics, Medical Informatics etc have wonderful contribution for sophisticated health development. The developed countries already take initiatives on improvement of medical systems by the Health Informatics powered systems and gradually this symptom has been increasing in other countries which are important and most valuable. The Bio and Eco Informatics and other areas also have role in their respective field and indirectly in the healthcare domain.

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