Where Code Meets Care: Shaping the Future of Digital Health at BMU

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In the CSE Department at BML Munjal University, led by Dr. Devanjali Relan, research explores how computational methods can be applied to address real-world challenges in healthcare. The work spans areas such as medical image analysis, where algorithms are developed to identify subtle patterns in microscopic and retinal images, supporting early and more reliable diagnosis. It also extends to AI-driven approaches for disease detection in veterinary applications, reflecting a broader vision of technology-enabled healthcare that goes beyond traditional boundaries.

At its core, this research is not just about building models, but about designing systems that are practical, interpretable, and impactful—where technology meaningfully contributes to improving healthcare outcomes.

These efforts are rooted in a larger reality. The healthcare field is constantly changing, with many of its greatest difficulties being more about disseminating information than a lack of knowledge. Delayed diagnoses, limited access to specialists, and fragmented healthcare systems continue to affect millions. Yet, within these challenges lies an opportunity: to rethink healthcare not just as a medical practice, but as an engineering problem waiting to be solved.

As part of this change, BML Munjal University (BMU) is increasingly incorporating Digital Health & Biomedical Engineering in its focus on using algorithm-based clinical diagnosis as a method for delivering care through Digital Health & Biomedical Engineering.

From Data to Diagnosis

Today, health care produces enormous amounts of data, including medical imaging, physiology signals and patient data; however, these vast amounts of data create little value due to how they have been analyzed. This is where Computer Science and Engineering (CSE) plays a transformative role.

Digital health is fundamentally a means by which raw data can be transformed into useful information. Algorithms that are built using medical images can reveal patterns that are not able to be seen by the naked human eye. Predictive models can be used to help predict risk before symptoms occur. Intelligent systems can help clinicians make faster and more accurate decisions.

At BMU, the process of transforming raw data into meaningful medical diagnoses is not just a theoretical exercise, but also a “hands-on” activity taking place within the CSE department of BMU. The ongoing research closely examines ways to leverage computer vision techniques for analyzing medical and microscopic images to enable the automated identification of very subtle patterns that would normally be difficult to identify through traditional manual approaches. The research undertaken in the context of retinal image analysis examines how computational modeling can also assist with identifying very subtle biomarkers, thus supporting the identification of disease at a more reliable and earlier stage.

Beyond the scope of human healthcare, significant efforts are also being made to develop AI-driven technologies to help identify diseases in animals at very early stages, demonstrating that digital health solutions can have broader societal and economic benefits.

Engineering Meets Medicine

The convergence of the disciplines of CSE with biomedical engineering is not coincidental; rather, it is a necessity. The majority of the issues facing healthcare today are complex problems that require knowledge of both biological systems and computational methods.

Biomedical engineering links engineering innovation to clinical practice with a comprehensive application of technology, which includes: medical imaging and biosignal analysis; wearable devices; and telemedicine platforms. The design of systems with increasing requirements for accurate, scalable and interpretable data is a central component of continuing innovation within the biomedicine sector.

The CSE Advantage at BMU

Within this evolving ecosystem, the **CSE department at BMU** provides a strong foundation for innovation in digital health.

The Department combines a solid understanding of the fundamentals with a focus on real-world problem-solving; with our students obtaining core knowledge in machine learning, computer vision, data science and intelligent systems, all of which are critical components of developing the technologies that will define modern health care.

In addition, BMU's CSE faculty also place a major emphasis on interdisciplinary research and application-based learning. Projects within CSE are approached not as separate academic projects, but in terms of addressing real societal needs, creating an environment where students learn how to develop systems that have an impact on the health care space.

Building a New Specialization

As technology continues to play an increasing role in the health field, BMU is preparing to offer a new specialization in Digital Health and Biomedical Engineering within the CSE department. The purpose of this area of study is not just to provide students with additional courses to select from; but rather to also prepare them for the next generation when technology will be integrated into all facets of the delivery of health care.

The Digital Health and Biomedical Engineering specialization addresses some of the following areas:

- Medical imaging analysis using artificial intelligence
- Bio signal processing
- Healthcare data systems
- Clinical diagnostic tools and decision support systems (also referred to as Clinical Decision Support or CDS)
- Integration of Internet of Things (IoT) and wearable technologies into patient care

The Digital Health and Biomedical Engineering specialization will couple technical skills with domain-specific skills so that students will feel equally confident in their ability to write computer programs, as well as to deliver care.

Learning Through Real Problems

One of the main characteristics of this area of study at BMU is that it allows students to learn through real-world problems. Unlike problems in other industries, health problems can be very large and complex, and there is often no single solution. In fact, health solutions must be robust, interpretable, and adaptable across a diversity of environments.

At BMU, students are motivated to see the complexity of the healthcare problem, because it requires both technical precision and practical usability in order for innovation to create a positive impact on the delivery of care. Supported by advanced computational infrastructure and exposure to industry-grade platforms such as NVIDIA technologies, students gain hands-on experience in building and deploying AI-driven solutions for healthcare applications.

In this manner, BMU is part of a larger shift in engineering education to promote an education that is beyond theory, and is focused on creating meaningful impact.

Towards a New Healthcare Paradigm

Healthcare is not likely to evolve in one giant step, but rather in a series of interconnected, incremental steps over time. Instead, it will be shaped by a series of interconnected innovations—smarter diagnostics, continuous monitoring, predictive analytics, and personalized treatment systems.

Among those developing solutions and innovations for the health care market will be engineers. The ability to design systems that can interpret data, adapt to variability, and function reliably in real-world settings will define the next generation of healthcare solutions.

At BMU, we are committed to strengthening this vision by supporting our Computer Science and Engineering department's mission of interdisciplinary innovation — thereby preparing our students for a role in shaping this new future, as well as positioning BMU as a leader in healthcare transformation.

Because in the end, the true potential of technology lies not in what it can compute, but in what it can care for.