

Informatics in Social Networks

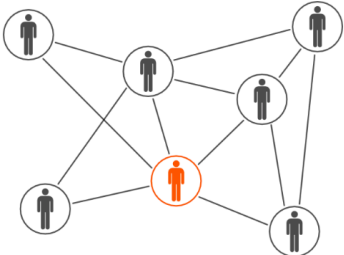
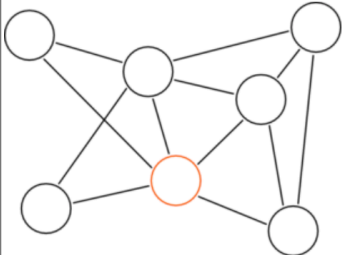
01/10/2018

For informal enquiry, please contact:

Dr. Xianhui Cherry Che
x.che@herts.ac.uk

Dr. Barry Ip
b.ip@herts.ac.uk

There is a close correlation between social networks and computer networks, where key components in both entities work in similar patterns. Just like link cables in computer networks where there are certain specifications such as bandwidth, the strength of relationships between people can be also quantified so that it is possible to determine who is more "popular" than others. Sociability is a metric that measures the strength of a user's connection to his/her social group. This measurement can be derived based on based on network constraint.

Social Network	Computer Network
	
Individual person	Workstation
Personality and characters	Workstation specs
People's relationship	Network links
Knowledge	Data

The power of social networks has significant impact on information dissemination around the globe. Such an impact can be harnessed within the field of computing in order to aid and enhance networking informatics.

The diagram below shows the semantic network of Weibo (one of the largest social network platforms in China) as an example in the study of informatics [1]. The sizes of the nodes are proportionate to the number of nodes linked to them. The distance between the words on the graph reflects the strength of relationship between each concept: that is, the frequency with which words are linked. Concepts with strong relationships appear closer together, while concepts with weak relationships are further apart. The research findings have revealed the top-three related keywords used most mostly frequently in this context: "infringe", "students", and "society", which gives a meaningful interpretation of the user concerns in the social network platform.



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Healthcare Informatics

For informal enquiry, please
contact:

Dr. Xianhui Cherry Che
x.che@herts.ac.uk

Dr. Barry Ip
b.ip@herts.ac.uk

Healthcare informatics is defined as the use of advanced computing technology to improve medical care, and it is sometimes loosely referred as healthcare analytics. The objectives of healthcare informatics are to increase the accuracy of diagnosis and the effectiveness of treatments, as well as eliminate complications that can potentially occur during medical treatments. Besides all these just mentioned, the overall purpose of healthcare is to improve the quality of life in general.

Healthcare informatics can be viewed as the intersection of three fields: healthcare (**Medical Analytics**), computer science (**CS**), and mathematics (**Math**). The first one is not essential for this PhD research, although the knowledge and skills required by the latter two (i.e. computer science and math) are crucial:

Computer Science:

- Databases and information management: Healthcare data is often dumped by electronic medical record (EMR) systems on demand or in the cloud. SQL can be used to select and transform specific data for specific purposes (such as to monitor and plan resources).
- Software programming: Building software systems that can satisfy user and patient requirements, such as to perform machine calculations that humans cannot practically do to manage or predict demand for certain services.
- Human-computer interaction: The study of how humans interact with computers. A current hot topic in medicine is how EMR applications can be made more intuitive and usable to physicians.
- Artificial intelligence: Machine learning is a sub-area within artificial intelligence, and represent a key area for future development.

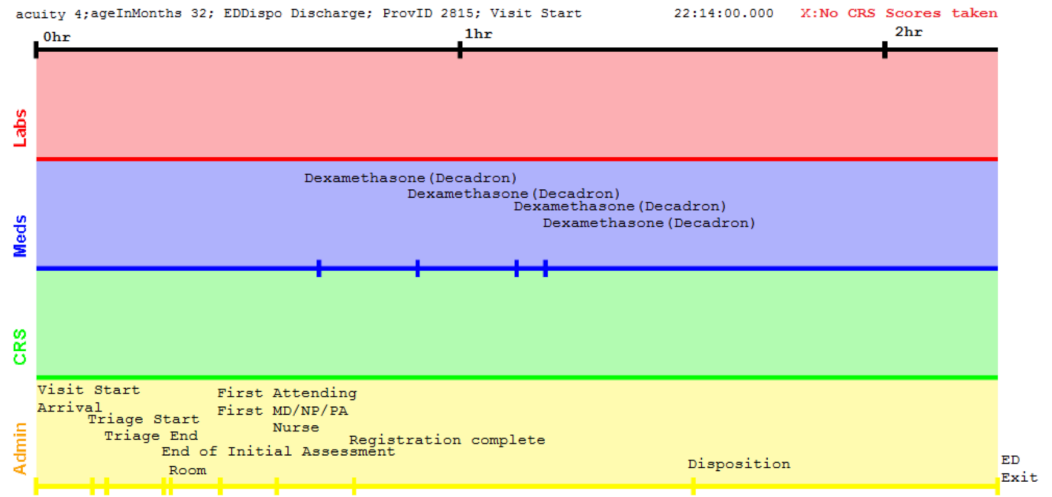
Mathematics:

- High-school mathematics: Subjects such as algebra, linear equations, and precalculus are essential foundations.
- Probability and statistics: Effective medical diagnosis and treatment rely heavily on probability and statistics, e.g. sensitivity, specificity, and likelihood ratios.
- Linear algebra: Commonly, the operations done on healthcare data while making machine learning models are vector and matrix operations.
- Calculus and optimization: Particularly applicable to neural networks and deep learning, as well as linear and nonlinear transformations of data. These allow for accurate modelling and prediction of data (more on this below).

In the actual research, you will not be expected to possess all the knowledge and skills as listed above. Depending on the specific research area, you will only need to focus on one or two specialised subjects. Examples of healthcare informatics applications are given below.

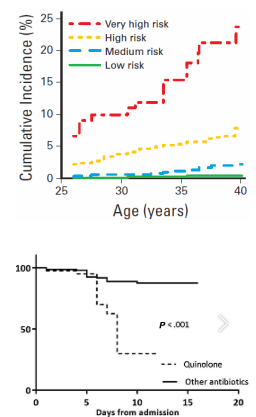
- **Example 1: visualisation of patient care**

A toddler's emergency care record system of asthma exacerbations uses structured clinical data, commonly found in EMR systems to summarize temporal relationships of the care events they have experienced. The visualization consists of four types of activities—administrative (yellow), diagnostic (green), medications (blue), and lab tests (red). These are encoded by colour and by y -position. Along the x -axis is time. The black bar on top is divided by vertical tick marks into hour-long blocks. This patient's visit lasted a little over two hours. Information about the patient is displayed before the black time bar.



- **Example 2: predicting future diagnosis and treatments**

Identifying high-risk patients can hinder or delay the onset of diseases or conditions is a common practice for this category. Examples of predictive analytics can be used for diseases including stroke, congestive heart failure, myocardial infarction, pneumonia, and chronic obstructive pulmonary. The technologies can also be used to identify patients who are at risk of requiring high-cost treatments, such as hospital readmissions and doctor visits. By identifying these patients, money-saving steps can be taken proactively to reduce the risk of these high-risk treatments.



Mobile Computing and Social Sensing

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For informal enquiry, please contact Dr. Xianhui Cherry Che
x.che@herts.ac.uk

The development of Wireless sensor network (WSN) is evolving from traditional applications that are designed for a specific set of physical scenarios in the industry, to a more pervasive provisioning such as Internet of Things (IoT). There is no universal solution for communication and computation protocols of WSNs, as each solution has to uniquely balance the system parameters and environmental conditions in order to achieve an optimized performance for the specific application. Nevertheless, the employment of modern smartphones has bypassed several obstacles that would be otherwise challenging for traditional WSNs, hence the implementation of pervasive sensing can become a reality.

The need for understanding, serving, and controlling the physical world demands the emergence of *sensing everywhere*. Collaborative and pervasive sensing is the future – a vision that can now be made possible with the unprecedented advantages, including the inescapable ownership of smartphones in the public society and the continuous growth of computing capacity of mobile phones.



In this research scheme, some practical work need to be carried out for the purpose of data collection and analysis, e.g. mobile app design, statistical modelling, etc. PhD research in other related areas such as social networks and IoT will also be considered.

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Usability in Mobile Apps

For informal enquiry,
please contact Dr.
Xianhui Cherry Che
x.che@herts.ac.uk

Modern smartphones have made huge impact on people's living style. There are currently millions of apps available in the app stores. Usability, or user experience, have become an increasingly assessed factor for mobile apps. Most existing usability models evaluate usability with qualitative attributes, such as effectiveness, efficiency and satisfaction, etc., [1]. However, none of these models have answered the real question here:

What makes a great mobile app?

In the context of a mobile app development module, it is crucial to comprehend the differences between desktop computing and mobile computing. While the former typically focuses on technical implementation, the latter tends to be more user-oriented. A common desktop application might be designed for a specific group of users, such as payment or billing system for a store checkout, payroll system, or a database facility. Functionality is therefore the ultimate goal for implementing such applications, and target users may be required to undergo some form of training prior to using the software. On the contrary, mobile apps usually face a wider audience where anyone from almost any part of the world can access the relevant app store to obtain and use the app on their device. Users may conceivably be from any background and vary entirely in gender, age, education, location, work experience, and so on. Such factors therefore place different requirements on app design as compared to more traditional desktop environments, where the latter must emphasise visual appeal and ease-of-use due to their potential of reaching diverse audiences. Within the context of mobile computing environment, visual impact can make great contribution to the user experience.



In addition, innovative I/O abilities amongst modern mobile devices (such as large touch screens, built-in sensors, and haptic feedback) and the relative convenience of access to app stores have changed the way in which users are exposed to and obtain such forms of software.

As a matter of fact, usability can be assessed using specific metrics, for example, when it comes to place a button on a mobile screen, the size of the button cannot be too small for the users to tap, especially during a motion condition. Apple's iPhone Human Interface Guidelines [2] recommend a minimum touch area size of 44 pixels wide and 44 pixels tall. This research needs to focus on similar measurements to this example, and present the standards of quantifying usability in a comprehensive pattern, through extensive literature review and surveys.

[1] Harrison, R., Flood, D. and Duce, D., 2013. Usability of mobile applications: literature review and rationale for a new usability model. *Journal of Interaction Science*, 1(1), p.1.

[2] Human Interface Guidelines, <https://developer.apple.com/design/human-interface-guidelines/>, Apple.

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Mobile Learning

*For informal enquiry, please
contact:*

Dr. Xianhui Cherry Che
x.che@herts.ac.uk

Dr. Raimund Kirner
r.kirner@herts.ac.uk

Within recent years, mobile computing has made a significant impact in the form of how users interact with their devices and for what purpose. It has been reported that users who use their mobile devices in their day to day life's, demand to run any application they want on any platform and despite the processing requirement. The increasing demand and popularity in a software application and hardware usage delivered through the world wide web as a service has resulted in a new convention adopted by mobile computing. Under this context, a new term "mobile learning" emerged combining the benefits of mobile computing and e-learning.

The development in mobile technology has expanded the path of flexible learning which overall allows the student to access relevant information at any time and within any given location given access to the internet. This type of progression in education through mobile devices provide limitless support to student's education and learning performance during both outside and inside classroom hours. Besides, a study has shown that mobile technology is more engaging to students than using desktop systems, this has been tested by allowing groups of students to use new technology such as iPad's, which overall compared to desktop systems has reinforced their engagements, excitements and overall motivation while studying.

The purpose of this research is to take advantage of mobile learning applications, in order to enhance individual learning and collaborative learning experiences. There are many different forms of challenges when implementing an e-learning platform on a mobile device to create a mobile-learning experience, mainly including:

- (1) The development process
- (2) Available infrastructure
- (3) Individual requirements
- (4) User acceptance