Artificial Intelligence in Health Care

Medical Education via Innovation in-Technology (MediTec)

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(MediTec)

Introduction to information technology

- **Course Description**
  - A first course in computer science and information technology, providing a comprehensive overview of computer architecture, data organization and communication. This course includes problem solving, logic design, personal computing, operating systems and application software.
- **Learning Objectives**

  By the end of this course, students will be able to:

  1. Intelligently discuss the history of computer technology.
  2. List the sequence of computer hardware switching technologies and discuss their advantages over previous hardware along with any inherent weaknesses.
  3. List the sequence of computer language generations and analyze their differences.
  4. Describe the computer language translation processes of assembly, interpretation and compilation.
  5. Describe how any type of information might be encoded as a series of numbers.
  6. Convert decimal numbers to binary and visa versa.
  7. Analyze a simple assembly language program and understand how it is converted to machine code and then executed.
  8. List the major functions of an operating system.
  9. Create a simple web page in HTML using only a text editor.
  10. Upload a web page to a web server
  11. Describe how static and dynamic web page URLs are processed
  12. Describe how routers work with TCP/IP to move information from source to destination.

Introduction to information technology (Cont.)

- **Objectives/Topics**
  - Introduction and History
  - Information and Binary
  - Hardware
  - Software
  - Networking
  - Databases
  - Computer Languages
  - Security
  - Robotics
  - Artificial Intelligence
  - Virtual Reality and Gaming
  - Social Implications
- **Prerequisites:**
  - None

Introduction to Healthcare Informatics

- **Course Description**
  - This course provides an introduction to health informatics, the field devoted to the optimal use of data, information, and knowledge to advance individual health, health care, public health, and health-related research. Students will learn the application of informatics skills and knowledge to health-related problems. Application activities will include simple data analysis and visualization of clinical data, answering clinical questions using information retrieval methods, and doing simple association analysis of gene variants and disease.
- **Learning Objectives**

  By the end of this course, students will be able to:

  1. Introduce students to problems and challenges that health informatics addresses
  2. Introduce students to the research and practice of health informatics
  3. Provide all students with basic skills and knowledge in health informatics to apply in their future
  4. health-related careers
  5. Lead students in discussion around ethical and diversity issues in health informatics
  6. Provide additional direction to those interested in further (i.e., graduate) study in the field

Introduction to Healthcare Informatics (Cont.)

- **Objectives/Topics**
  - Overview of Field and Problems That Motivate It
  - Health Data, Information, and Knowledge
  - Personal Health Records and Decision Aids
  - Information Retrieval (Search)
  - Bioinformatics
  - Informatics Applications in Public Health
  - Data Science, Analytics, and Visualization
  - Ethical Issues in Health Informatics
- **Prerequisites:**
  - None

Introduction to Artificial Intelligence with Python

- **Course Description**
  - This course explores the concepts and algorithms at the foundation of modern artificial intelligence, diving into the ideas that give rise to technologies like game-playing engines, handwriting recognition, and machine translation. Through hands-on projects, students gain exposure to the theory behind graph search algorithms, classification, optimization, reinforcement learning, and other topics in artificial intelligence and machine learning as they incorporate them into their own Python programs. By course's end, students emerge with experience in libraries for machine learning as well as knowledge of artificial intelligence principles that enable them to design intelligent systems of their own.

- **Learning Objectives**

  By the end of this course, students will be able to:

  1. The difference between the two main types of machine learning methods: supervised and unsupervised
  2. Supervised learning algorithms, including classification and regression
  3. Unsupervised learning algorithms, including Clustering and Dimensionality Reduction
  4. How statistical modeling relates to machine learning and how to compare them
  5. Real-life examples of the different ways machine learning affects society

Introduction to Artificial Intelligence with Python (Cont.)

- **Objectives/Topics**
  - Introduction to Machine Learning
    - Applications of Machine Learning
    - Supervised vs Unsupervised Learning
    - Python libraries suitable for Machine Learning
  - Regression
    - Linear Regression
    - Non-linear Regression
    - Model evaluation methods
  - Classification
    - K-Nearest Neighbour
    - Decision Trees
    - Logistic Regression
    - Support Vector Machines
    - Model Evaluation

Introduction to Artificial Intelligence with Python (Cont.)

- **Objectives/Topics**
  - Unsupervised Learning
    - K-Means Clustering
    - Hierarchical Clustering
  - Density-Based Clustering
    - Recommender Systems
    - Content-based recommender systems
    - Collaborative Filtering
- **Prerequisites:**
  - Probability and statistics
  - Mathematics

Data Analytics

- **Course Description**
  - This course prepares students to gather, describe, and analyze data, and use advanced statistical tools to make decisions on operations, risk management, finance, marketing, etc. Analysis is done targeting economic and financial decisions in complex systems that involve multiple partners. Topics include probability, statistics, hypothesis testing, regression, clustering, decision trees, and forecasting.

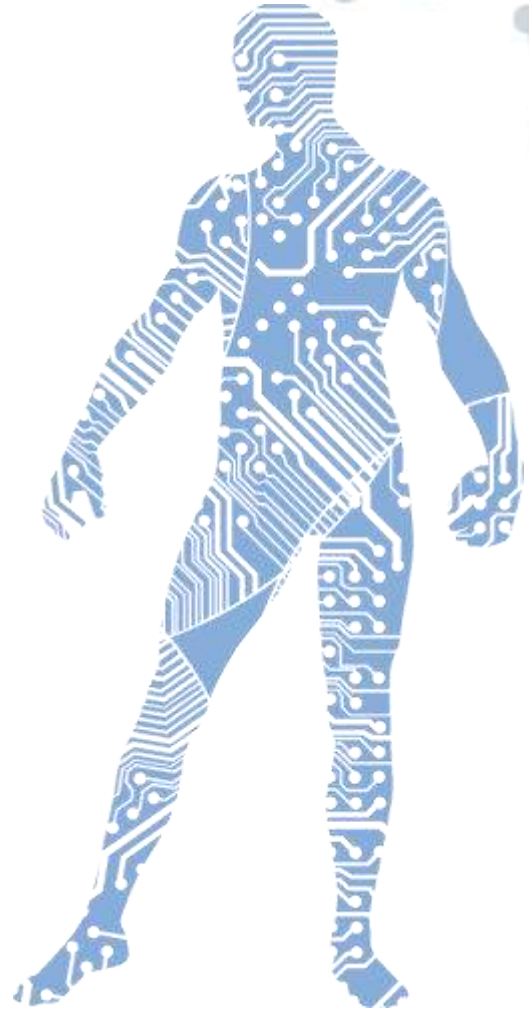
- **Learning Objectives**

  By the end of this course, students will be able to:

  1. Gather sufficient relevant data, conduct data analytics using scientific methods, and make appropriate and powerful connections between quantitative analysis and real-world problems.
  2. Demonstrate a sophisticated understanding of the concepts and methods; know the exact scopes and possible limitations of each method; and show capability of using data analytics skills to provide constructive guidance in decision making.
  3. Use advanced techniques to conduct thorough and insightful analysis, and interpret the results correctly with detailed and useful information.
  4. Show substantial understanding of the real problems; conduct deep data analytics using correct methods; and draw reasonable conclusions with sufficient explanation and elaboration.
  5. Write an insightful and well-organized report for a real-world case study, including thoughtful and convincing details.
  6. Make better business decisions by using advanced techniques in data analytics.

Data Analytics (Cont.)

- **Objectives/Topics**
  - Introduction, Data Summarization and Visualization.
  - Linear and Nonlinear Regression.
  - Model Selection.
  - Classification, Logistic Regression.
  - Clustering.
  - Decision Trees.
- **Prerequisites:**
  - None



Data Computational Models and Training

- **Course Description**
  - This course provides an overview of the how and the whys of computational modeling. This course is not intended to be a general survey of computational models of human cognition. Instead, we will talk about what models are, why we use models, how to recognize good modeling versus bad modeling, how to implement a model, how to fit a model to data, how to evaluate the fit of a model, how to compare and contrast competing models, how to evaluate special cases of a model, and how to develop and test new models. We will talk about a number of real-world practical issues involved in implementing models. We will primarily talk about models that account for response probabilities, response times, and neurophysiology in a few selected domains. We will talk about why we develop and test models, when it is appropriate and inappropriate to test models, what kinds of choices are made when developing a model, what are the best ways to use modeling most effectively, and what we can learn from models. The techniques and issues we talk about apply to all kinds of modeling, from very abstract cognitive models to micro-level neural models
- **Learning Objectives**

  By the end of this course, students will be able to:

  1. To implement models, simulate models, make model predictions, fit models to data, and contrast competing models.
  2. Know the tools and background to take a more critical eye to modeling work you might read in the literature.
  3. Solve practical issues like using MATLAB, random number generators, Monte Carlo simulations, using the high-performance computing facility at ACCRE, speeding up simulations, using bootstrapping techniques, and simulating differential equations.

Data Computational Models and Training (Cont.)

- **Objectives/Topics**
  - Introduction to Computational (Cognitive) Modeling
  - Implementing a Computational Model
  - Fitting Models to Data.
  - Comparing Different Models.
  - Continued Discussion of Model Comparison Techniques
  - More Model Comparison Techniques and Introduction to Monte Carlo Techniques
  - Monte Carlo Techniques
  - Response Time Modeling
  - Fitting RT models to data
  - Simulating Stochastic and Deterministic Differential Equations
  - Continued Discussion of simulating models defined by differential equations. When a good fit can be bad
  - When a good fit can be bad. Fitting, Predicting, and Generalizing
- **Prerequisites:**
  - None

Machine and Deep Learning

- **Course Description**
  - Machine learning and artificial intelligence hold the potential to transform healthcare and open up a world of incredible promise. But we will never realize the potential of these technologies unless all stakeholders have basic competencies in both healthcare and machine learning concepts and principles. This course covers deep learning (DL) methods, healthcare data and applications using DL methods.
- **Learning Objectives**

  By the end of this course, students will be able to:

  1. Define important relationships between the fields of machine learning, biostatistics, and traditional computer programming.
  2. Learn important approaches for leveraging data to train, validate, and test machine learning models.
  3. Learn about advanced neural network architectures for tasks ranging from text classification to object detection and segmentation.
  4. Learn deep learning models such as deep neural networks, convolutional neural networks, recurrent neural networks, autoencoder, attention models, graph neural networks and deep generative learning.
  5. Learn different healthcare applications using DL methods such as clinical predictive models, computational phenotyping, patient risk stratification, treatment recommendation, clinical natural language processing, and medical imaging analysis

Machine and Deep Learning (Cont.)

- **Objectives/Topics**
  - Introduction
  - Machine learning basics
  - Concepts and Principles of machine learning in healthcare part 1
  - Concepts and Principles of machine learning in healthcare part 2
  - Health data
  - Deep Neural Networks (DNN)
  - Embedding
  - Convolutional Neural Networks (CNN)
  - Recurrent Neural Networks (RNN)
  - Autoencoders
  - Attention Models
  - Graph Neural Networks
  - Memory network
  - Deep generative models
- **Prerequisites:**
  - Probability and statistics
  - Mathematics

Electronic Health Records

- **Course Description**
  - An introduction to the electronic health record (EHR). Students will study the use of the EHR in improving healthcare quality, accessibility, and cost-effectiveness. EHR implementation and its use within the internal clinical office will be examined. The EHR will be studied in the context of a comprehensive Health Information System (HIS) supporting our society's interdisciplinary clinical healthcare system.

- **Learning Objectives**

  By the end of this course, students will be able to:

  1. Define the terminology associated with the EHR
  2. Describe how implementation of the EHR improves patient quality, access, and cost-savings within the context of an interdisciplinary healthcare system.
  3. Analyze the characteristics of the Electronic Health Record (EHR) as a component of a comprehensive Health Information Systems (HIS).
  4. Understand the role of EHR software for improving workflow efficiency within the context of a medical clinic.
  5. Identify privacy and security concerns involving the adoption and use of the EHR.
  6. Utilize an EHR software package to: document patient care; create electronic orders; search, sort, and filter data; analyze clinical trends; improve workflow efficiency; generate reports, flow sheets, and anatomic drawings; and improve patient safety through clinical accuracy.

Electronic Health Records (Cont.)

- **Objectives/Topics**
  - Define the terminology associated with the EHR
  - Describe how implementation of the EHR improves patient quality, access, and cost-savings within the context of an interdisciplinary healthcare system
  - Analyze the characteristics of the Electronic Health Record (EHR) as a component of a comprehensive Health Information Systems (HIS)
  - Understand the role of EHR software for improving workflow efficiency within the context of a medical clinic
  - Identify privacy and security concerns involving the adoption and use of the HER
  - Utilize an EHR software package to: document patient care; create electronic orders; search, sort, and filter data; analyze clinical trends; improve workflow efficiency; generate reports, flow sheets, and anatomic drawings; and improve patient safety through clinical accuracy.
- **Prerequisites:**
  - Introduction to Healthcare Informatics

AI Bias

- **Course Description**
  - Engage in this course pertaining to a highly impactful yet, too rarely discussed, AI-related topic. You will learn from international experts in the field, also speakers at IVADO's International School on Bias and Discrimination in AI, which took place in Montreal, and explore the social and technical aspects of bias, discrimination and fairness in machine learning and algorithm design.

- **Learning Objectives**

  By the end of this course, students will be able to:

  1. Understanding bias and discrimination in all its aspects
  2. Exploring the harmful effects of bias in machine learning (discriminatory effects of algorithmic decision-making)
  3. Identifying the sources of bias and discrimination in machine learning
  4. Mitigating bias in machine learning (strategies for addressing bias)
  5. Recommendations to guide the ethical development and evaluation of algorithms

AI Bias (Cont.)

- **Objectives/Topics**
  - The concepts of bias and fairness in AI
    - Different Types of Bias
    - Fairness criteria and metrics
  - Fields where problems were diagnosed
    - Privacy, labor and legal system
    - Public policy and Health
  - Institutional attempts to mitigate bias and discrimination in AI
    - Canada's Algorithmic Impact Assessment Framework
    - The Montreal Declaration for Responsible AI
  - Technical attempts to mitigate bias and discrimination in AI
    - Fairness constraints in graph embedding's
    - Gender bias in text
- **Prerequisites:**
  - Mathematics
  - Programming

Interactive in Machine Learning

- **Course Description**
  - Many applications of machine learning involve interactions with humans. Humans may provide input to a learning algorithm, including input in the form of labels, demonstrations, corrections, rankings, or evaluations. And they could give such input while observing the algorithm's outputs, potentially in the form of feedback, predictions, or demonstrations. Although humans are an integral part of the learning process, traditional machine learning systems used in these applications are agnostic to the fact that inputs/outputs are from/for humans. However, a growing community of researchers at the intersection of machine learning and human-computer interaction are making interaction with humans a central part of developing machine learning systems. These efforts include applying interaction design principles to machine learning systems, using human-subject testing to evaluate machine learning systems and inspire new methods, and changing the input and output channels of machine learning systems to better leverage human capabilities. This course focuses on interactive machine learning (IML), which I define to be machine learning with a human in the learning loop, observing the result of learning and providing input meant to improve the learning outcome

- **Learning Objectives**

  By the end of this course, students will be able to:

  1. Understand the current literature on IML
  2. Identify unexplored research topics
  3. Practice finding and choosing research problems
  4. Become acquainted with sequential decision-making and research methods in ML and HCI
  5. Identify common themes and goals within IML research especially those unique to the intersection of HCI and ML
  6. Hands-on experience creating interactive machine learning systems
  7. Conduct novel research on IML

Interactive in Machine Learning (Cont.)

- **Objectives/Topics**
  - Introduction
  - Decision Making and Decision Support
  - From Expert Systems to Explainable AI
  - Overview of Explanation Methods and Transparent Machine Learning Algorithms
  - Supervised learning
  - Evaluation by techniques/standards of Human-computer interaction and Machine learning
  - Sequential decision making
    - Learning from demonstration
    - Reinforcement learning
  - Unsupervised learning (e.g. clustering)
- **Prerequisites:**
  - Machine and Deep Learning
  - Programming

Using AI for Disease Diagnosis and Patient Monitoring

- **Course Description**
  - AI is transforming the practice of medicine. It’s helping doctors diagnose patients more accurately, make predictions about patients’ future health, and recommend better treatments. As an AI practitioner, you have the opportunity to join in this transformation of modern medicine. If you're already familiar with some of the math and coding behind AI algorithms, and are eager to develop your skills further to tackle challenges in the healthcare industry, then this specialization is for you.

- **Learning Objectives**

  By the end of this course, students will be able to:

  1. Create convolutional neural network image classification and segmentation models to make diagnoses of lung and brain disorders.
  2. Build risk models and survival estimators for heart disease using statistical methods and a random forest predictor to determine patient prognosis.
  3. Build a treatment effect predictor, apply model interpretation techniques and use natural language processing to extract information from radiology reports.

Using AI for Disease Diagnosis and Patient Monitoring (Cont.)

- **Objectives/Topics**
  - Disease detection with computer vision
  - Medical Image Diagnosis
  - Eye Disease and Cancer Diagnosis
  - Building and Training a Model for Medical Diagnosis
  - Training, prediction, and loss
  - Image Classification and Class Imbalance
  - Binary Cross Entropy Loss Function
  - Impact of Class Imbalance on Loss Calculation
  - Resampling to Achieve Balanced Classes

Using AI for Disease Diagnosis and Patient Monitoring (Cont.)

- **Objectives/Topics**
  - Multi-task Loss, Dataset size, and CNN Architectures
  - Generating More Samples
  - Model Testing
  - Splitting data by patient
  - Evaluating models
  - Image segmentation on MRI images
- **Prerequisites:**
  - Machine and Deep Learning
  - Programming

Introduction to Data Science and its Relation to AI

- **Course Description**
  - The course gives a broad introduction to various techniques and theories used in Data Science and Artificial Intelligence (AI), with particular focus on their practical applications.
- **Learning Objectives**

  By the end of this course, students will be able to:

  1. Describe fundamental types of problems and main approaches in data science and AI
  2. Give examples of data science and AI applications from different contexts
  3. Give examples of how stochastic models and machine learning (ML) are applied in data science and AI
  4. Explain basic concepts in classical AI, and the relationship between logical and data driven, ML-based approaches within AI.
  5. Briefly explain the historical development of AI, what is possible today and discuss possible future development
  6. Use appropriate programming libraries and techniques to implement basic transformations, visualizations and analyses of example data
  7. Identify appropriate types of analysis problems for some concrete data science applications
  8. Implement some types of stochastic models and apply them in data science and AI applications
  9. Implement and/or use AI-tools for search, planning and problem solving
  10. Apply simple machine learning methods implemented in a standard library

Introduction to Data Science and its Relation to AI (Cont.)

- **Objectives/Topics**
  1. Introduction to Data Science. Getting started with Python
  2. Regression and classification
  3. Clustering
  4. Bayesian statistics and graphical models
  5. Markov models, kernel methods and decision trees
  6. Introduction to AI and its ethics
  7. Machine learning and neural networks
  8. Rule-based AI
- **Prerequisites:**
  - None

Operational Systems: Relational and Non-Relational Databases

- **Course Description**
  - The growth of the internet has brought along with it the phenomena of Big Data and its massive quantities of rapidly evolving, unstructured information. The need to process and store this information in a timely and cost effective way has led to the adoption of the computer cluster as the infrastructure of choice. The adoption of computer clusters as a primary tool in the IT world has given greater impetus to the development of distributed systems that take full advantage of this infrastructure. Apache Spark is an example of such a distributed system for data processing. This course is about distributed persistence technologies, focusing on NoSQL databases, and their query languages.

- **Learning Objectives**

  By the end of this course, students will be able to:

  1. Distinguish the different types of NoSQL databases
  2. Understand the impact of the cluster on database design
  3. State the CAP theorem and explain it main points
  4. Explain where HBase, MongoDB, Cassandra, Neo4j, and Redis fit with the CAP theorem
  5. Work with the Hadoop Distributed File System (HDFS) as a foundation for NoSQL technologies
  6. Warehouse HDFS data using Apache Hive
  7. Data mine HDFS data with Apache Spark-SQL and Apache Pig
  8. Describe the design of HBase, MongoDB, Cassandra, Neo4j, and Redis
  9. Use the data control, definition, and manipulation languages of the NoSQL databases covered in the course

Operational Systems: Relational and Non-Relational Databases (Cont.)

- **Objectives/Topics**
  1. Introduction to Data Science. Getting started with Python
  2. Review of the Relational Model
  3. ACID Properties
  4. Distributed Databases: Shading and Replication
  5. Consistency
  6. The CAP Theorem
  7. NoSQL Data Models
  8. Overview of HDFS, HDFS Deployment, Core HDFS Services, and Federated and High Availability HDFS
  9. Multi-node Cluster with Docker, Apache Hive as an HDFS, and Data Warehouse Hbase
- **Prerequisites:**
  - Introduction to information technology

Analytical Systems: Data Warehousing and Mining

- **Course Description**
  - Introduces data mining concepts and processes along with data warehouse design and reporting. Applications are from health care and public health. In contemporary organizations, usable information is critical for running the organization and making good decisions at all levels. This unit considers the importance of effective decision making and the role that data and information play in the process. In addition, connections are made to the computer information systems skills and infrastructure that support the collection of data and its transformation into information.

- **Learning Objectives**

  By the end of this course, students will be able to:

  1. Describe the importance of making good organizational decisions.
  2. State characteristics of an effective decision.
  3. State key elements of effective decision making processes.
  4. Distinguish between foundation information and feedback information and the role of each in a decision making process.
  5. Define data mining.
  6. Define induction-based learning.
  7. Define computer learning.
  8. Describe three views of concepts from the standpoint of computer learning of concepts.
  9. Explain what concept learning from data is and how computers learn from data.
  10. Define supervised learning.
  11. Distinguish between supervised learning and unsupervised clustering.

Analytical Systems: Data Warehousing and Mining (Cont.)

- **Objectives/Topics**
  - Review of the Relational Model
  - The Nature of Organizational Decision Making
  - The Role of Data and Information in Organizational Decision Making
  - Effective Decision Processes
  - Decision Support Systems
  - Concepts of Business Intelligence
  - First Concepts of Data Mining
  - Problems that Data Mining Helps Solve
- **Prerequisites:**
  - Data Analysis

Healthcare Data Analytic

- **Course Description**
  - This introductory course is designed for graduate students who intend to understand the process of analysis of patient data, genomic databases, and electronic health records (EHR) to improve patient care, and to achieve greater efficiencies in public and private healthcare systems. The course explores the concept of clinical intelligence and the role of analytics in supporting a data-driven learning healthcare system. The aim is to focus beyond data collection, to analyzing available data and making it into actionable information. Key topics include the value-driven healthcare system, measuring health system performance, existing quality/performance measurement frameworks (HEDIS), Analytics maturity model (DELTA), comparing healthcare delivery, attributes of high performing healthcare systems, and the IT infrastructure and human capital needed to leverage analytics for health improvement. We will also look at open-source and web-based warehousing tools to perform practical use of healthcare analytics.

Learning Objectives

By the end of this course, students will be able to:

1. Describe the changing context of healthcare services, including the trend value-based healthcare systems and the role of data in promoting improved outcomes
2. Import data from electronic health record (EHR) systems into data warehousing system and use analytics tools.
3. Design data models that integrate patient data from multiple sources to create comprehensive, patient-centered views of data
4. Design an analytic strategy to frame a potential issue and solution relevant to the health improvement of patient populations
5. Analyze the distribution of disease and health outcomes in relevant populations of interest(e.g., general population, health system members, patient subgroups) as well as geographic regions and represent data on Maps (GIS tools)
6. Apply clinical analytics to various contexts of quality improvement (e.g., chronic disease, patient use, population health, public health)

Healthcare Data Analytic (Cont.)

- **Objectives/Topics**
  - Basics of data analysis for the Jordan healthcare system
  - Healthcare Data Acquisition and Management
  - Applied Statistics for Healthcare Analytics
  - Quantitative Methods in Healthcare Management
  - Data Mining for Healthcare Analytics
  - Systems Medicine for Predictive Analytics
- **Prerequisites:**
  - Data analytics
  - Introduction to Healthcare Informatics

Healthcare Delivery Systems

- **Course Description**
  - To introduce student to the historic development, organization and characteristics of the health care delivery system; current payment and reimbursement systems; accrediting agencies applicable to health care; the functions of health care providers; organizational patterns of health care facilities; medical staff organization and bylaws; and to the health information management profession from its beginnings to the present.

Learning Objectives

By the end of this course, students will be able to:

1. Identify components and functions of multiple health care delivery systems to include accreditation, licensure, regulations, payment, and reimbursement systems.
2. Describe routine institutional statistics.
3. Interpret health care data.
4. Prepare health care data for presentation purposes
5. Evaluate reliability and validity of health care data.
6. Explain the evolution of the health care systems in the United States.
7. Identify the social, legal, and economic factors that affect the delivery of health care.
8. Explain the development of the health information profession from its beginnings until the present and into the future.
9. Describe the historical development of healthcare reimbursement in the United States.
10. Describe the critical health policy issues in the U.S. and explain the future trends in health care.

Healthcare Delivery Systems (Cont.)

- **Objectives/Topics**
  - The nature of the health care system.
  - The concepts of health and disease, risk factors, and the role of health promotion and disease prevention
  - The history of mental health care
  - Health services professionals and their training, practice requirements, and practice settings.
  - The role of health care financing and its impact on the delivery of health care
  - Understand the meanings of outpatient, ambulatory and primary care
  - Understand the reasons for the subsequent decline of hospitals and their utilization
  - Grasp the basic concepts of managed care and how managed care organizations achieve cost savings.
  - The population groups facing greater challenges and barriers in accessing health care services
  - The meaning of health care costs and review recent trends
  - The major forces of future change that affect health care delivery
  - The concept of long-term care (LTC) and its main features
- **Prerequisites:**
  - None

Health Data Content and Structure

- **Course Description**
  - The purpose of this course is to introduce students to traditional record-keeping concepts and concepts related to the paper and electronic health records. The student will also learn the differences associated with record-keeping practices in hospitals, ambulatory care facilities, and long term care facilities.

Learning Objectives

By the end of this course, students will be able to:

1. Analyze health record content.
2. Describe health information management department function and purpose.
3. Differentiate the various types of health care facilities and their records.
4. Identify the various licensing and regulatory agencies in the healthcare industry.

Health Data Content and Structure (Cont.)

- **Objectives/Topics**
  - Describe the Health Information Department.
  - Define the Patient Record: Hospital, Physician Office, and Alternative Care Settings
  - Describe the Content of the Patient Record: Inpatient, Outpatient, Nursing Home and Physician Office
  - The management of medical record content
  - Numbering & Filing Systems and Record Storage & Circulation
  - The Indexes, Registers, and Health Data Collection
- **Prerequisites:**
  - None

Health Data Management

- **Course Description**
  - An introduction to the use of technology in the capture, delivery and analysis of health data. The course focuses on the use of electronic health records, data mining, statistical collection of health data, quality data management, report generation and health data project management. Students interact with simulations of key EHR and HIM tasks.

Learning Objectives

By the end of this course, students will be able to:

1. Apply policies and procedures to ensure the highest accuracy and integrity of health data both internal and external to the health system.
2. Collect and maintain health data.
3. Apply system security policies according to departmental and organizational data/information standards.
4. Utilize software in the completion of HIM processes.
5. Explain current trends and future challenges in health information exchange.
6. Apply graphical tools for data presentations.
7. Utilize basic descriptive, institutional, and population healthcare statistics.
8. Validate the reliability and accuracy of secondary data sources.
9. Explain the process used in the selection and implementation of health information management systems.

Health Data Management (Cont.)

- **Objectives/Topics**
  - Data Content, Structure and Standards
    - Data Management
  - Informatics, Analytics and Data Use.
    - Health Information Technologies
    - Information Management Strategic Planning
    - Analytics and Decision Support
    - Health Care Statistics
    - Consumer Informatics
    - Health Information Exchange.
  - Leadership Subdomain
    - Project Management
    - Vendor/Contract Management
- **Prerequisites:**
  - Healthcare Delivery Systems
  - Health Data Content and Structure

Cloud Computing in Healthcare

- **Course Description**
  - In the final course of the Healthcare IT Support program, we will focus on the types of healthcare data that you need to be aware, complexities of security and privacy within healthcare, and issues related to compliance and reporting. As a health IT support specialist, you'll be exposed to different types of data sources and data elements that are utilized in healthcare. It's important for you to understand the basic language of healthcare data and for you to recognize the sensitive nature of protected health information (PHI). Maintaining data privacy and security is everyone's responsibility, including IT support staff! We'll go into detail about HIPAA and the risks associated with security breaches, ransomware and phishing. We'll go into detail about some of the key laws and regulations specific to healthcare and the importance of compliance with them.

- **Learning Objectives**

  By the end of this course, students will be able to:

  1. Discuss the relevance of course material and the use of health care informatics to a biblical worldview.
  2. Examine health care record systems.
  3. Evaluate scalable health information systems to identify how integrative applications are developed across varying health care information technologies.
  4. Design an elastic health care information system based upon dynamic and innovative health care information technology needs.

Cloud Computing in Healthcare (Cont.)

- **Objectives/Topics**
  - Healthcare Data
    - Common Data Types in Healthcare
    - Demographic Data in Healthcare
    - Data in Healthcare: Diagnoses and Medications
    - Behind the Scenes: Healthcare Data De-identification
  - Healthcare Data Security and Privacy
    - HIPAA
    - Covered Entities
    - Protected Health Information
    - Behind the Scenes: HIPAA Privacy Rule
    - Security Breaches in Healthcare

Cloud Computing in Healthcare (Cont.)

- **Objectives/Topics**
  - Encryption and Cloud Computing
    - Protecting Sensitive Healthcare Data
    - Encryption
    - Cloud Computing in Healthcare
    - Fraud and Abuse Laws
  - Healthcare Laws and Compliance
    - Joint Commission
    - Quality and Health
    - Quality Measures
    - Conclusion and Farewell
- **Prerequisites:**
  - Introduction to Artificial Intelligence with Python
  - Probability and statistics

Data Governance in Healthcare

- **Course Description**
  - This course covers tech- and data-related topics in healthcare including electronic health records, health IT privacy and security, health information exchanges, IT for revenue cycle management, healthcare data analytics, technologies for diagnosis and treatment, and big data applications in healthcare.

Learning Objectives

By the end of this course, students will be able to:

1. Evaluate processes in healthcare facilities using technological tools.
2. Apply project management principles to a healthcare IT project
3. Develop strategies to implement EHR systems
4. Prepare a HIPAA compliance plan from an IT perspective
5. Apply statistical methods to analyze healthcare data
6. Analyze healthcare data using technological tools such as spreadsheets and R.
7. Evaluate healthcare quality improvement processes and quality measures

Data Governance in Healthcare (Cont.)

- **Objectives/Topics**
  - Why Data Quality Matters
    - Course Introduction
    - Why Data is Collected and Defining Quality
    - Why Data Quality Matters, Part
    - How Data Quality Assessment Varies in Different Data Uses
  - Measuring Data Quality
    - Describing Metadata in Healthcare4m
    - Data Provenance in Healthcare4m
    - Components of Data Quality4m
    - Data Validation Methods5m
    - A Framework for Validating and Verifying Data6m
    - The SBAR Methodology

Data Governance in Healthcare (Cont.)

- **Objectives/Topics**
  - Monitoring, Managing and Improving Data Quality
    - Establishing the Culture of Quality throughout the Data Lifecycle
    - Improving Data Quality from the Baseline
    - Managing Data Quality: Expected and Unexpected Changes
    - Monitoring Strategies Along the Data Pipeline
  - Sustaining Quality through Data Governance
    - Defining Data Governance in Healthcare
    - Why Data Governance Matters in Healthcare
    - Data Governance Committees in Healthcare
- **Prerequisites:**
  - None

Business Application of Machine Learning and Artificial Intelligence in Healthcare

- **Course Description**
  - The future of healthcare is becoming dependent on our ability to integrate Machine Learning and Artificial Intelligence into our organizations. But it is not enough to recognize the opportunities of AI; we as leaders in the healthcare industry have to first determine the best use for these applications ensuring that we focus our investment on solving problems that impact the bottom line.
- **Learning Objectives**

  By the end of this course, students will be able to:

  1. Determine the factors involved in decision support that can improve business performance across the provider/payer ecosystem.
  2. Identify opportunities for business applications in healthcare by applying journey mapping and pain point analysis in a real world context.
  3. Identify differences in methods and techniques in order to appropriately apply to pain points using case studies.
  4. Critically assess the opportunities to leverage decision support in adapting to trends in the industry.

Business Application of Machine Learning and Artificial Intelligence in Healthcare (Cont.)

- **Objectives/Topics**
  - Decision Support and Use Cases
    - Consumerism, Supply Chain and Social & Situational Determinants
    - Operationalizing Consumerism Using ML and AI
    - Operationalizing a New Supply Chain
    - Machine Learning, Artificial Intelligence, and Decision Support
    - Journey Mapping and Pain Points, Patient Monitoring, Differential Diagnosis, Care Management, Preventive Screening, and Avoidable Readmissions
  - Predictive Modeling Basics
    - Predictive Modeling, Linear Regression and Disease Burden as a Predictor of Cost
    - Machine Learning, Data Sourcing, Data Enrichment, Provider Taxonomies and Relationships and Predictive Modeling Process

Business Application of Machine Learning and Artificial Intelligence in Healthcare (Cont.)

- **Objectives/Topics**
  - Consumerism and Operationalization
    - Analytic Maturity Model, Identifying Historic Addressable Opportunity, Predicting Addressable Opportunity, and Measuring Predictive Accuracy.
    - Integration and Orchestration, and Operational Engagement Framework
  - Advanced Topics in Operationalization
- **Prerequisites:**
  - Mathematics
  - Programming

Human Factors Engineering

- **Course Description**
  - The future of In this course, students review and critique traditional and emerging human factors engineering approaches, concepts, and methods and apply them to contemporary health informatics problems. Class activities include discussions and interactive peer review of articles, presentations, and original research proposals.
- **Learning Objectives**

  By the end of this course, students will be able to:

  1. Apply human factors engineering, including its principles and subspecialties.
  2. Evaluate a health informatics problem using human factors engineering concepts and methods.
  3. Critique scientific articles and other readings on human factors engineering.
  4. Synthesize knowledge from different areas of human factors engineering to solve a contemporary health informatics problem.
  5. Develop and communicate a research study proposal to apply human factors engineering to a contemporary health informatics issue.

Human Factors Engineering (Cont.)

- **Objectives/Topics**
  - What is Human Factors?
  - What is Consumer Health Information Technology/eHealth?
  - Work Systems Models, Workflow Research and Field Research Methods
  - Implementation, Adoption, and Acceptance
  - Macrocognition
  - User-Centered Design
  - Online Patient Education
  - Distributed Cognition
  - Cognitive Workload
  - Naturalistic Decision Making
  - Resilience Engineering / Safety
- **Prerequisites:**
  - None

Biodesign for Digital Health

- **Course Description**
  - Health care is facing significant cross-industry challenges and opportunities created by a number of factors including: the increasing need for improved access to affordable, high-quality care; growing demand from consumers for greater control of their health and health data; the shift in focus from “sick care” to prevention and health optimization; aging demographics and the increased burden of chronic conditions; and new emphasis on real-world, measurable health outcomes for individuals and populations. Moreover, the delivery of health information and services is no longer tied to traditional “brick and mortar” hospitals and clinics: it has increasingly become "Digital," enabled by apps, sensors, wearables and the cloud; simultaneously, it has been augmented and often revolutionized by emerging digital and information technologies, as well as by the data that these technologies generate. This multifactorial transformation presents opportunities for innovation across the entire cycle of care, from wellness, to acute and chronic diseases, to care at the end of life

- **Learning Objectives**

  By the end of this course, students will be able to:

  1. Be able to ask informed questions and apply critical thinking to understand the evolving digital health industry sector.
  2. Be able to recognize, describe and apply the needs-driven Biodesign approach to the creation of innovative concept solutions in digital health.
  3. Have developed or refined the soft skills required to work in teams and with the support of external advisers and mentors towards achieving and presenting digital health projects outcomes.

Biodesign for Digital Health(Cont.)

- **Objectives/Topics**
  - Introduction; Overview of Digital Health
  - Digital Health Needs
  - Enabling Technologies
  - Designing for Health
  - Policy
  - Business Models / Validation
  - Entrepreneurship
  - Corporate Perspectives
  - Digital Health Regulatory Topics
- **Prerequisites:**
  - None

Consumer Health Informatics

- **Course Description**
  - Consumer health informatics (CHI) is a rapidly-expanding area of informatics practice, with career opportunities emerging in the public, non-profit and private sectors. Broadly, the field aims to give individual health care consumers, as well as their families and communities, the information and tools that they need to help them become more involved in their health and health care. In this course, students will become familiar with a range of CHI applications, including the needs/problems that the applications address, their theoretical bases, their technical architectures, and relevant evaluation results. Building on this prior CHI work, students will acquire an ability to evaluate existing applications, and to generate theory-informed design and implementation strategies for CHI applications. Students will also learn to assess the needs and technological practices of potential users, with a particular focus on groups that experience health and information access disparities, and to select appropriate evaluation approaches based on an application's technological maturity.

- **Learning Objectives**

  By the end of this course, students will be able to:

  1. Compare and evaluate a range of consumer health informatics (CHI) applications.
  2. Generate CHI design and implementation principles and guidelines that incorporate theories from the behavioral, social and environmental sciences.
  3. Assess consumers' health-related needs, resources and technology-oriented practices, and evaluate their implications for CHI applications.
  4. Plan the design, implementation and evaluation of a new, theory-informed CHI application to address the health need(s) of a particular audience.
  5. Develop a commitment to CHI practice with diverse user groups.

Consumer Health Informatics (Cont.)

- **Objectives/Topics**
  - Introduction
  - Health behavior change
  - Socio-cognitive theory (SCT) to the design of consumer health
  - Tracking, Records and Remote Monitoring
  - Consumer health informatics (CHI) applications.
  - Theory-informed CHI application
  - Social support and informal care
  - Community and Environmental Health
- **Prerequisites:**
  - None

Design Innovation for Health System Challenges

- **Course Description**
  - This course explores the complex challenges existing within our health system and teaches a design-innovation framework to identify solutions. It uses the aging population and increasing advanced chronic disease as the main case study. Initially, the course examines how major health care services are organized and financed in Ontario, Canada, how this affects care, and what are the strengths, challenges, and opportunities in the current system. The course then applies design innovation framework to generate system-level solutions.
- **Learning Objectives**

  By the end of this course, students will be able to:

  1. To understand how the current complexities within Ontario's health system create systemic challenges for patients, providers, and administrators.
  2. To understand the value and stages of the human-centered design process.
  3. To apply this process to generate solutions to current health system issue

Design Innovation for Health System Challenges (Cont.)

- **Objectives/Topics**
  - Intro to Course; View of the Future & Laying Big Bets
  - Pain points in the Homecare Sector
  - Pain points in the Physician Sector
  - Pain points in the Hospital Sector
  - Innovation Strategies
  - Business Models
  - Intro to Human-Centered Design
- **Prerequisites:**
  - None