Certificate Course in Criminal Justice Data Analysis

August 17 - November 5, 2020

Introduction

Research is the core of modern professional internal security issues today. Criminal justice is increasingly a data-driven function and CJ organizations process substantial data that reflect the social, political, economic factors impacting Indian society. Vast amount of criminal justice data is being collected throughout India. The nation-wide Crime and Criminal Tracking Network and Systems (CCTNS), as well sixty years of *Crime in India* data, new sources such as 'Dial 100' system across the country are providing big data to practitioners, researchers and policy makers. Combined with additional social, political and economic data and geographic information systems that provide spatial maps and allow incorporation of temporal phase, significant new heights can be scaled for effective crime control with data analytics and visualization.

The major objective of this course will be to train security personnel in analytic tools for study of crime and its control in India. Big Data analytics is among today's fastest-growing professions and this course seeks to build skills in applying its techniques for internal security of the country. The course will incorporate subject matter from the disciplines of criminology, computing science, mathematics, geography, economics, psychology, management, philosophy and ethics, with special emphasis upon gender, race and ethnic studies. Topics will cover Big Data Analytics comprising machine learning and AI applications as well as qualitative methods. Students will study ways of understanding and modeling of the complex social & political environment, and with these models better understand how to improve approaches to crime reduction and the use of analytics in criminal justice issue.

Who should enroll?

The course is designed for officers of Indian police, private security managers, senior officers of defense services, internal security policy analyst, CJ practitioners and researchers. In particular, this course is designed for those seeking to enhance their skills and capabilities in crime prevention techniques. Graduate students of political science, sociology, criminology, computer science, mathematics, and management will also benefit from this course.

Educational Requirements

The minimum educational requirement is a bachelor's degree and experience of working with computers. In this course you'll learn quantitative and qualitative methods for data analysis through hands-on exercises and video instruction from IIT Kanpur faculty and guest faculty from other institutions around the globe.

Time Frame

You can complete all courses requirements in this course and earn your certificate in 12 weeks, spending 5-7 hours per week.

What you will learn

- Theories of crime that suggest why people commit crime
- Criminal Justice Data Sources
- Criminal Justice Data Visualization
- Research Design, machine learning, network analysis, survey design in criminal justice issues,
- Formulate crime control questions that can be tested using various methods.
- Use CJ data to test policy outcome

Special features

- Lectures, text transcripts, readings, discussions, and projects will be accessible 24 hours a day for the entire duration of the course
- Learning outcomes will be evaluated through multiple choice quizzes and instructor-moderated discussions
- The course will provide opportunities for collaboration and networking with fellow participants, renowned faculty and CJ practitioners both during and after the end of the course
- Every student will work on a project and present at the end of the course
- Flexibility in the course admin to adjust to officers' requirements

Course Topics

[Note: Special topics will be covered through Guest Lectures]

Week 1-2
Criminological Perspectives & Crime Pattern Analysis
Instructor: Drs Arvind Verma

Week 3-4 Machine Learning: Principles & Predicting Crimes through Artificial Intelligence
Instructor: Dr Nisheeth Srivastava

Week 5-6 Social Network Analysis for Crime and Terrorist Networks
Instructor: Dr. Shankar Prawesh

Week 7-8 Qualitative Methods in Criminal Justice
Instructor: Dr Arvind Verma

Week 9-10 Crime Visualization: Principles & Applications
Instructor: Dr. SK Lodha

Week 11-12
Project Work
Administrator: Dr Arvind Verma

Time Schedule

Aug 17 – Nov 6, 2020

Evaluation

Weekly Assignments/ Exercises/ Quizzes	90%
Project Presentation	10%

Registration Procedure

Click here for directions from Center for Continuing Education, IIT Kanpur

Brief Description of the Course Modules

Criminological Perspectives & Crime Pattern Analysis
Arvind Verma

The major objective of this module is to educate the police leaders to learn how research is the foundation of professional policing and how they can apply criminological perspectives in their work functions. We will examine a variety of criminological theories and associated research that has provided robust tools, pragmatic and realistic ways to deal effectively with crime. The module will further educate about geography of crime to understand crime patterns, become familiar with principles of Problem-Oriented Policing, Predictive Policing, Evidence Based Policing and Analysis of Criminal Justice Data. Several case studies will be discussed to highlight the importance of research in police functions and how it has helped transformed law enforcement agencies in various parts of the world. The course will help police leaders transform their units into knowledge-based organization to reform Indian police from within.

Machine Learning: Principles & Predicting Crimes through Artificial Intelligence:
Nisheeth Srivastava

In this module students will learn about different techniques of time series analysis. The emphasis will be to understand which one is suitable for a specific data set. Rather than delving into the details of precisely how these techniques actually work, the focus will be on understanding which one will work best for a chosen data set. Students will be given hands-on problems to apply these techniques using the CCTNS data. These exercises will show how to report predictions and what confidence in predictions can be estimated correctly.

The second part of the module will introduce basic machine learning methods for applications on criminal justice data. Students will work out case examples to comprehend how these may be useful in finding interesting co-variates for predicting crime trends. The class assignments will incorporate partial algorithms and students will be required to fill piece of code

and test on sample data.

Social Network Analysis for Crime and Terrorist Networks
Shankar Prawesh

In this module we will learn about using social network analysis to examine organized crimes and terrorist networks. There will be three main components:

1. Understand basic concepts of a social network. We will also learn a software for analysis and visualization of the network data. The following topics will be covered:
    a. Social network analysis in criminal studies
    b. Basics of network data representation; Centrality and network measures, such as degree betweenness, diameter, density, and network visualization in Gephi
    c. Social networks theories
2. Next, we will examine two real-life crime related social network datasets using the social networks metrics discussed in the previous module. In particular, we will discuss few case studies, and work with following datasets:
    (a) Terrorist network dataset (UCINet dataset), and
    (b) Swedish street gang dataset
3. To understand application of social networks concepts, we will work on a project in which students are expected to use social network perspective to study a Drug trafficking network.

The application of network perspective for data analysis will enable police leaders to process large-scale crime related datasets to generate a better insight about the terrorist/ crime related networks and to use network theories to solve real crime cases.

Qualitative Techniques
Dr. Arvind Verma

Qualitative methods allow the researchers to investigate the *meaning* people attribute to their behavior, actions, and interactions with others. These techniques are designed to reveal what the respondent has in mind and help investigate interpretations, symbols, the processes and relations of social interactions. What this type of research produces is descriptive data that the researcher must then interpret using rigorous and systematic methods of transcribing, coding, and analysis of trends and themes. In this course you will learn about the foundations of qualitative techniques and three specific methods of survey design, content analysis and observation. The course module will incorporate case studies from police research to illustrate these techniques. Assignments will include small exercises to help understand applications of these techniques in police related subjects.

Methods

Sample Surveys: While many surveys are designed to generate quantitative data, many are also designed with open-ended questions that allow for the generation and analysis of qualitative data. For example, a survey might be used to investigate not just what proportion of citizens do not like to the police station to lodge their complaint but also why they expect that officers will be unhelpful, in their own words.

Content Analysis: This method is used by criminologists to analyze deviance by interpreting words and images from documents, film, art, music, and other cultural products and media. The researchers look at how the words and images are used, and the context in which they are used to draw inferences about the underlying reasons for considering some action to be deviant. Content analysis of unsavory messages, especially generated by social media users, has become a useful technique for police officers.

Crime Visualization: Principles & Applications
Suresh Lodha

The main goal of this topic is to understand how visualization can help in the analysis and elucidation of patterns from data. We will study design principles including using color effectively propounded by Jacques Bertin, Edward Tufte, Stephen Few, Hans Rosling and Cole Nussbaumer. The effort will be to train students towards visual story-telling for effective communication. Practical component of the course will be explored using QGIS and criminal justice data.

There will be five main modules:

Module 1: Classical Principles of Visualization

This module will cover classical principles such as “maximizing data ink”, reducing clutter and confusion based upon work of Edward Tufte and Jacques Bertin.

Module 2: Choosing the Right Data and Right Graph

This module will cover theories of Cole Nussbaumer, Hans Rosling and Stephen Few to choose data that brings out the story one wants to emphasize.

Module 3: Principles of Color

This module will cover principles of color selection and will discuss color-brewer scale.

Module 4: QGIS

This module will introduce QGIS to create variety of graphs and GIS mapping for working with visualization layers.

Module 5: Exercise in Story Telling with Criminal Justice Data

Students will be asked to utilize real criminal justice data to bring out the insights central to data.

Additional aspects such as data reliability, consistency, uncertainty will also be discussed.

Project Work
Arvind Verma & Faculty supervisor

Every student will identify a topic for project work in consultation with Course Administrator Dr. Arvind Verma. The student will work with one of the course instructors and or any faculty assigned by the administrator. The topic will be one that is directly related to the job functions engaged by the student or a special subject. It is expected that the student will use one or more of the techniques learned in the course and apply them to address a special problem of the police organization. The project work will involve collection and analysis of data and a [power point] presentation at the end of the course to the course administrator. Successful presentation is necessary for completion of the course and earning the certificate from IITK.

Certification

After completion of all the assignments and successful presentation the students will be awarded a Certificate in Criminal Justice Data Analysis by IIT Kanpur.