Syllabus: Computational Forensics & AI

Instructor:	Rita Singh	**Website:**	forensics.cs.cmu.edu
Email:	rsingh@cs.cmu.edu	**Affiliation:**	Carnegie Mellon University

With new AI-based technologies that power almost all activities in the digital world, cybercrime is on an unprecedented increase. Forensics is the science of tracing causes, methods and perpetrators from evidence, once a crime has been committed. This course will teach you some of the key technologies that are being used to track cybercriminals.

Course Structure:

Week 1: Introduction to 21st century crime and computational forensics

- The taxonomy of crimes under international law and laws of specific countries
- The role of computational forensics in criminal investigations
- Broad divisions of forensic sciences and focus areas for this course

Week 2: Network Forensics

- Key steps in the creation of the internet
- Breaches and cyber attacks

Week 3: Dark Web Forensics

- Key technologies that power the dark web
- Key steps in tracing dark web evidence

Week 4: Computer Forensics

- Hard drives and hardware
- Data acquisition (laptops, servers, cellphones)
- File systems
- File carving and file recovery
- Operating systems (users, passwords, permissions, logs, registry)
- Applications (email, browser, database, sms)
- Physical to virtual (P2V) conversions

Week 5: Cryptography

- The principles of cryptography
- Cryptography and cyber attacks

Week 6: Image Forensics

- Basics of image processing: storage and manipulation of images
- Image forensics

Week 7: Steganography

- Basics of information hiding (steganography)
- Steganography in cybercrimes
- Detecting hidden information (steganalysis)

Week 8: Machine Learning in Forensics

- Basics of machine learning
- Application of ML to forensic analysis

Week 9: Deep Learning and AI in Forensics

- Deep learning basics
- Application of AI to forensic analysis

Week 10: Text and Social Media Forensics

- Basics of social media, and related cybercrimes
- Techniques used in social media forensics

Week 11: Video Forensics

- Video processing basics
- Forensic analysis of videos

Week 12: Audio Forensics

- Audio processing basics
- Audio forensics (including voice forensics)

Week 13: DeepFakes Generation and Tracking

- Deepfaked video: generation and detection
- Deepfaked audio: generation and detection

Week 14: Advanced Tracking Techniques

- Biometrics and surveillance
- Computational fingerprint analysis