

Glossary of key terms based on Modules 1 - 8:

1. **A.I. (Artificial Intelligence):** The theory and development of computer systems able to perform tasks that normally require human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.
(ITAI 1370 Spr 2024 Lect 01 - Tagged.pdf, page 10)
2. **Algorithms (in ML):** Pre-built math equations that show the machine how to understand your data. ML uses specialized frameworks and libraries, as well as innovative techniques, which are constantly improving. Algorithms are important, but without data, they are ineffective.
(ITAI 1370 Module 05 ML 2024 - Tagged.pdf, page 7)
3. **Automated Reasoning:** To use stored information to answer questions and to draw new conclusions. This would be needed for a computer attempting to pass the **Turing Test** to use stored information to answer questions and draw new conclusions [ITAI 1370 2023 History Mod 02.pdf, page 19].
4. **Big Data:** Large datasets that are so voluminous and complex that traditional data processing software tools are inadequate to capture, store, manage, and analyze them. The challenges of big data management result from the expansion of volume, variety, and velocity. Big data also includes veracity and value. Big data requires specialized tools and techniques for storage and analysis. It often contains the complex patterns that deep learning models excel at extracting. [ITAI 1370 Module 05 ML 2024.pdf, page 5]
5. **Business Intelligence (BI):** Comprises the strategies and technologies used by enterprises for the data analysis of business information. BI technologies provide historical, current, and predictive views of business operations. Common functions include reporting, online analytical processing, analytics, data mining, process mining, complex event processing, business performance management, benchmarking, text mining, predictive analytics, and prescriptive analytics. BI technologies can handle large amounts of structured and sometimes unstructured data to help identify, develop, and otherwise create new strategic business opportunities. AI is merging with BI. [A.I. Module 06 ITAI 1370.pdf, pages 31-32].
6. **Categorical Data:** Data such as gender, nationality, or eye color. There are ordinal data with a set order or scale, and nominal data without meaningful order. Understanding the differences between numerical and categorical data is crucial for choosing the appropriate ML Model [ITAI 1370 Module 05 ML 2024.pdf, page 6-7]

7. **Cloud Rendering:** Enable a shift towards 3D cloud rendering services, which provide scalable, high-performance rendering capabilities to meet growing demands for photorealism and tight deadlines. [1370 Spr 2024 Mod 4 Games Part 2 - Tagged.pdf, page 8].
8. **Computer Graphics:** Development was key to the Evans & Sutherland Company (1968). Ivan Sutherland created the 1st interactive computer graphics program. Rendering is the process of generating 2D images from 3D models by applying textures, lighting, shadows etc.. [1370 Spr 2024 Mod 4 Games Part 2 - Tagged.pdf, page 5, 14]
9. **Computer Vision:** Enables machines to understand visual information from the world like humans do. It is the manipulation and analysis of pixels in digital images to extract useful information. Computer Vision is Deep Learning.
(A.I. Module 06 ITAI 1370.pdf, page 3) & (ITAI 1370 Spr 2024 Mod 09 Computer Vision How computers see - Tagged.pdf, page 4)
10. **Convolutional Neural Networks (CNNs):** A main architecture of neural networks, particularly used for image data and have a primary use in image processing, computer vision, and image recognition. CNNs function by identifying patterns through the use of "filters". This process allows CNNs to recognize shapes, textures, and objects within images. [ITAI 1370 Spr 2024 Mod 08 Neural Networks Architecture - Tagged.pdf, pages 2, 6-7]
11. **Data:** Any type of information, whether quantitative or qualitative, that can be used to gain insight or inform decisions. It can come from a variety of sources, such as surveys, experiments, observations, and databases. Data is the fuel for ML engines and the training material that algorithms learn from. [ITAI 1370 Spr 2024 Mod 08 Neural Networks Architecture - Tagged.pdf]
12. **Data Augmentation:** Increase training data artificially, used in deep learning for small data. [ITAI 1370 Spr 2024 Mod 08 Neural Networks Architecture - Tagged.pdf]
13. **Data Mart:** Contains a copy of analytical data that facilitates decision support; related to data warehouses and BI. [A.I. Module 06 ITAI 1370.pdf]
14. **Data Science:** Interdisciplinary field related to AI, Machine Learning, and Deep Learning. Data Science as an Invaluable Pre-cursor to Machine Learning is a key idea. [A.I. Module 06 ITAI 1370.pdf]
15. **Data Warehouse (DW):** Contains a copy of analytical data that facilitate decision support; related to BI. [A.I. Module 06 ITAI 1370.pdf]

16. **Dark Data:** Collected and stored data that is not analyzed. Can be structured, semi-structured, or unstructured, and comes from sources like customer records, social posts, sensor and machine logs. Dark data can reduce model performance and increase development time, leading to missed opportunities. [ITAI1370 Mod 06 2024 Intro to AI ML Pipeline - Tagged.pdf, page 3]
17. **Deep Learning (DL):** A type of Machine Learning. Brain Inspired Deep Learning is (Loosely) based on the human brain. It requires extensive, high-quality labeled data and significant GPU power. Models can lack transparency and have a risk of overfitting. [ITAI 1370 Mod 07_2024_ Deep Learning Basics - Tagged.pdf, page 2]
18. **Eco-Friendly Rendering Practices:** Growing importance, including the use of energy-efficient algorithms and renewable energy sources for powering render farms. [1370 Spr 2024 Mod 4 Games Part 2 - Tagged.pdf]
19. **Features (in ML):** The observations that are used to form predictions. For image classification, the pixels are the features; for voice recognition, pitch and volume are the features; for autonomous cars, data from cameras, sensors, and GPS are features. Extracting relevant features is important for building a model. Features are measurable data that helps make predictions. [ITAI 1370 Module 05 ML 2024 - Tagged.pdf, page 6]
20. **Generative Adversarial Networks (GANs):** A main architecture of neural networks. GANs leverage the adversarial relationship between a Generator and a Discriminator, enabling the creation of highly realistic data from noise. [ITAI 1370 Spr 2024 Mod 08 Neural Networks Architecture - Tagged.pdf, page 8]
21. **GPU Engine:** Software libraries, frameworks, or APIs that enable developers to harness the computational power of Graphics Processing Units (GPUs) for a wide range of tasks beyond graphics rendering. [1370 Spr 2024 Mod 4 Games Part 2 - Tagged.pdf, page 8]
22. **Image Processing (in CV):** The manipulation and analysis of pixels in digital images to extract useful information from them. [ITAI 1370 Spr 2024 Mod 09 Computer Vision How computers see - Tagged.pdf, page 3]
23. **Knowledge Graph:** A key part of the Semantic Web. It is a semantic network with the added constraint that edges are restricted to be from a limited set of possible relations, to facilitate algebras on the graph. It aims to represent things, not strings. Google introduced their Knowledge Graph in 2012. Knowledge Graphs provide ML models with additional features, can generate synthetic labeled data, and represent

ML data in a more machine-readable way. [A.I. Module 06 ITAI 1370.pdf, page 13] & [ITAI1370 Mod 06 2024 Intro to AI ML Pipeline - Tagged.pdf, page 7]

24. **Label (in ML):** The output that you want to predict. Sometimes called the target. Requires training data with labels in supervised learning. [ITAI 1370 Module 05 ML 2024 - Tagged.pdf, page 6]
25. **Machine Learning (ML):** The practice of teaching a computer to learn using pattern recognition and predictive algorithms to make judgments on incoming data. It is closely related to artificial intelligence and computational statistics. ML requires large amounts of data and a lot of processing power, often using hardware acceleration like GPUs. ML uses specialized frameworks and libraries and innovative techniques. [ITAI 1370 Module 05 ML 2024 - Tagged.pdf, page 2]
26. **Natural Language Processing (NLP):** To enable a computer to communicate successfully in English. Transformers are a model for NLP. [A.I. Module 06 ITAI 1370.pdf, page 3]
27. **Neural Networks (NNs):** Brain inspired deep learning is loosely based on the human brain. The NN creates weights and biases using a process. Key architectures include Convolutional Neural Networks, Recurrent Neural Networks, Long Short – Term Memory Networks, Generative Adversarial Networks, Graph Neural Networks, Capsule Networks, and Transformers. [A.I. Module 06 ITAI 1370.pdf, page 2]
28. **Ontology (in computer science and information science):** Encompasses a representation, formal naming and definition of the categories, properties and relations between the concepts, data and entities that substantiate one, many or all domains of discourse. More simply, it is a way of showing the properties of a subject area and how they are related, by defining a set of concepts and categories that represent the subject. Often equated with taxonomic hierarchies of classes, class definitions, and the subsumption relation. [A.I. Module 06 ITAI 1370.pdf, page 8]
29. **Overfitting:** Models may not generalize well beyond training data. Big data helps mitigate overfitting in deep learning. Regularization techniques are used to prevent overfitting in deep learning for small data. [ITAI 1370 Module 05 ML 2024 - Tagged.pdf, page 5]
30. **RaaS (Rendering as a Service) Tech Evolution:** Next-gen GPUs enable more efficient, real-time rendering; web interfaces simplify access. Business Innovation involves flexible pricing and industry-specific services expand SME reach. AI & ML optimizes rendering for higher quality and speed. Ecosystem & Automation involves seamless software integration and automated workflows streamline processes.

Sustainability & Security emphasizes eco-friendly practices and robust data protection. Collaborative Dynamics includes enhanced tools for synchronous collaboration and project interaction. [1370 Spr 2024 Mod 4 Games Part 2 - Tagged.pdf, page 9]

31. **RDNR Token:** An innovative approach to decentralized rendering using Blockchain Technology, ensuring secure and transparent management of digital assets within the rendering ecosystem. [1370 Spr 2024 Mod 4 Games Part 2 - Tagged.pdf, page 8]
32. **Rendering:** The process of creating images from models via computer algorithms. Not just for gaming. Recent developments in GPU technology have marked significant progress in performance.[1370 Spr 2024 Mod 4 Games Part 2 - Tagged.pdf, page 1]
33. **Semantic Network:** A knowledge base that represents semantic relations between concepts in a network. It is a directed or undirected graph consisting of vertices (concepts) and edges (semantic relations). Often used as a form of knowledge representation and in natural language processing applications. Considered an excellent precursor to today's Neural Networks. [A.I. Module 06 ITAI 1370.pdf, page 9]
34. **Semantic Web:** A concept designed to enable machines to understand the meaning of information on the Web. The aim is to set up a network of links between structured data in addition to hyperlinks. Technologies include RDF, OWL, and SPARQL. The Semantic Web can improve ML performance by providing additional features, improving interpretability, and reducing reliance on labeled data. [ITAI1370 Mod 06 2024 Intro to AI ML Pipeline - Tagged.pdf, page 7]
35. **Small Data:** Datasets that are manageable in size and complexity by traditional databases and analytical methods. Small data can be easily managed, processed, and analyzed with standard tools. It often focuses on specific, targeted questions or problems. [ITAI 1370 Spr 2024 Mod 08 Neural Networks Architecture - Tagged.pdf, page 3]
36. **Speech Recognition:** Technology that advanced and found its way into game development, allowing for new gameplay mechanics like voice-controlled actions. Games offer a diverse dataset for accents, dialects, and languages, pushing AI research on understanding natural language and context.[1370 Module 03 Spring 2024 - Tagged.pdf, pages 27-30]

37. **Supervised Learning:** Tries to predict a specific label by using features. Requires training data with labels and can directly measure model performance. [ITAI 1370 Module 05 ML 2024 - Tagged.pdf, page 7]
38. **Transfer Learning:** Taking a model trained on a large dataset and fine-tuning it on a smaller dataset, used in deep learning for small data. Google's T-5 is about Transfer Learning, using a text-to-text format for various language problems. [A.I. Module 06 ITAI 1370.pdf, page 17]
39. **Transformers:** A cutting-edge AI model that excels at understanding context in data, especially language. It considers the relationship between data to grasp the bigger picture and has revolutionized tasks in AI from translation to chatbots. Does not require sequential data to be processed in order, allowing for more parallelization. Used in NLP tasks. Examples include BART, BERT, Claude2, Deberta, DistilBERT, GPT, LaMDA, Llama 2, mT5/T5, Megatron-Turing NLG, PaLM, RoBERTa, Wav2Vec 2.0, and XLNet. [A.I. Module 06 ITAI 1370.pdf, page 17]
40. **Turing Test:** Proposed by Alan Turing (1950) to provide a satisfactory operational definition of intelligence. A computer passes the test if a human interrogator cannot tell whether written responses come from a person or a computer. [ITAI 1370 2023 History Mod 02.pdf, page 5]
41. **Unsupervised Learning:** Looks for structure or unusual patterns to understand the data. Doesn't use labeled data and usually provides an indirect evaluation. [ITAI 1370 Module 05 ML 2024 - Tagged.pdf, page 7]
42. **Virtual Reality (VR):** High Definition and Immersive Video Technology VR is a key area. Explored in relation to AI. [1370 Spr 2024 Mod 4 Games Part 2]
43. **Zero-shot Learning:** Develop models capable of learning without any specific task data, focusing on versatility and adaptability; used in deep learning for small data. [97, ITAI 1370 Spr 2024 Mod 08 Neural Networks Architecture - Tagged.pdf, page 3]