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AI/ML SOLUTIONS FOR FINANCIAL SERVICES

AI/ML FOR FINANCIAL SERVICES
PAUL J DAVIS

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01

AI/ML Solutions for Financial Services

02

ML & AI Algorithms

03

Data Management and Preprocessing + Lab

04

Credit Risk Assessment

05

Fraud Detection & Prevention + Guest Speaker

06

Trend Forecasting & Prediction + Lab

07

Trading & Portfolio Management + Guest Speaker

08

Robotic Process Automation (RPA) + Guest Speaker

09

Customer Segmentation & Personalization + Lab

10

Natural Language Processing: Virtual Assistants & Chat Bots + Lab

11

Implementing AI & ML Solutions

12

Ethical and Regulatory Considerations + Guest Speaker

13

Career Guidance & Outlook

SYLLABUS REVIEW

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CLASS AGENDA

01 WHAT IS AI & ML?

02 SKILLS NEEDED FOR A DATA SCIENTIST OR DATA ENGINEER

03 AI & ML SOLUTIONS FOR FINANCIAL SERVICES

04 KEY TERMINOLOGY & SOFTWARE RELATED TO BANKING

05 MACHINE LEARNING PIPELINE & WORKFLOW

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WHAT IS AI/ML?

AI and ML are two closely related fields in computer science that deal with the development of systems and algorithms that can perform tasks typically requiring human intelligence.

AI and ML technologies have seen widespread adoption and have applications in a wide range of industries, from healthcare and **finance** to autonomous vehicles and natural language processing. These fields continue to evolve, with ongoing research and development leading to advancements in both theory and practical applications.

WHAT IS AI/ML?

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ARTIFICIAL INTELLIGENCE (AI)

Artificial Intelligence is a broad field of computer science that focuses on creating systems or machines that can perform tasks that would normally require human intelligence. These tasks can include reasoning, problem-solving, learning, understanding natural language, recognizing patterns, and more. AI can be divided into two categories:

A. **Narrow or Weak AI:** This type of AI is designed to perform specific tasks or solve particular problems. It operates under a limited pre-defined set of capabilities and does not possess general intelligence. Examples of narrow AI include voice assistants (e.g., Siri, Alexa), recommendation systems (e.g., Netflix recommendations), and autonomous vehicles.

B. **General or Strong AI:** General AI refers to AI systems that possess human-level intelligence and can understand, learn, and adapt to a wide range of tasks and situations. Such AI is currently theoretical and does not yet exist.

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MACHINE LEARNING (ML)

Machine Learning is a subfield of AI that focuses on the development of algorithms that allow machines to learn from and make predictions or decisions based on data. Instead of being explicitly programmed to perform a task, ML models are trained using large datasets to learn patterns, make predictions, and improve their performance over time. ML can be divided into various types, including:

A. **Supervised Learning:** In this type of ML, models are trained on labeled data, where the input and the corresponding output are provided. The model learns to map inputs to outputs.

B. **Unsupervised Learning:** Unsupervised learning involves training models on unlabeled data, and the model's goal is to find hidden patterns or group data points based on similarities.

C. **Reinforcement Learning:** Reinforcement learning is used for training agents to make a sequence of decisions to maximize a reward within an environment. It is commonly used in applications like game playing and robotics.

D. **Deep Learning:** Deep learning is a subset of machine learning that uses artificial neural networks, particularly deep neural networks with many layers, to model and solve complex tasks. It has been particularly successful in tasks such as image and speech recognition.

SKILLS NEEDED FOR A DATA SCIENTIST OR DATA ENGINEER

Data scientists and data engineers play essential roles in the field of data analysis and data-driven decision-making.

While their specific roles and responsibilities may vary, there are several key skills and knowledge areas that are commonly needed for success in these positions.

Both data scientists and data engineers may have overlapping skills, but their primary focus and responsibilities differ.

Data scientists concentrate on extracting insights and making data-driven decisions, while data engineers are responsible for the collection, storage, and management of data to enable those data-driven decisions.

SKILLS NEEDED FOR A DATA SCIENTIST OR DATA ENGINEER

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01

STATISTICAL ANALYSIS AND DATA MODELING

Data scientists should have a strong understanding of statistical methods and data modeling techniques to analyze and interpret data effectively.

02

PROGRAMMING SKILLS

Proficiency in programming languages such as Python or R is crucial for data manipulation, analysis, and visualization.

03

MACHINE LEARNING

Familiarity with machine learning algorithms and techniques is important for building predictive models and making data-driven predictions.

04

DATA CLEANING AND PREPROCESSING

Data scientists often spend a significant amount of time cleaning and preprocessing data to ensure its quality and relevance.

05

DATA VISUALIZATION

Being able to present insights and findings effectively through data visualization tools (e.g., Matplotlib, Seaborn, Tableau) is a valuable skill.

SKILLS NEEDED FOR A DATA SCIENTIST

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06

DOMAIN KNOWLEDGE

Understanding the industry or domain you're working in is essential for interpreting data and making informed decisions that align with business goals.

07

COMMUNICATION SKILLS

Data scientists need to communicate their findings and insights to both technical and non-technical stakeholders.

08

BIG DATA TECHNOLOGIES

Familiarity with big data tools and technologies like Hadoop, Spark, and distributed computing is important when dealing with large datasets.

09

DATABASE MANAGEMENT

Knowledge of databases and query languages (e.g., SQL) is crucial for accessing and manipulating data.

10

EXPERIMENTATION AND A/B TESTING

Understanding experimental design and A/B testing is important for testing hypotheses and making data-driven decisions.

SKILLS NEEDED FOR A DATA SCIENTIST

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01

DATA WAREHOUSING

Data engineers design and maintain data warehouses and data pipelines to ensure data is stored efficiently and is accessible for analysis.

02

ETL (EXTRACT, TRANSFORM, LOAD) PROCESSES

Data engineers are responsible for developing ETL processes to clean, transform, and load data from various sources into data warehouses.

03

DATABASE MANAGEMENT

Proficiency in database systems and query languages like SQL is crucial for data storage and retrieval.

04

BIG DATA TECHNOLOGIES

Data engineers often work with big data technologies such as Hadoop, Spark, and NoSQL databases to handle large-scale data.

05

PROGRAMMING SKILLS

Knowledge of programming languages like Python, Java, or Scala can be important for building data pipelines and automating processes.

SKILLS NEEDED FOR A DATA ENGINEER

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06

DATA ARCHITECTURE

Understanding data architecture and data modeling is essential for designing efficient data systems.

07

DATA SECURITY

Data engineers must ensure data security and compliance with regulations to protect sensitive information.

08

CLOUD SERVICES

Familiarity with cloud platforms (e.g., AWS, Azure, GCP) for data storage and processing is often required.

09

VERSION CONTROL

Proficiency with version control systems (e.g., Git) is important for collaborating on data engineering projects.

10

PROBLEM-SOLVING SKILLS

Data engineers need to be adept at problem-solving to optimize data pipelines and troubleshoot issues efficiently.

SKILLS NEEDED FOR A DATA ENGINEER

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AI & ML SOLUTIONS FOR FINANCIAL SERVICES

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Artificial Intelligence (AI) and Machine Learning (ML) have had a significant impact on the financial services industry, offering a wide range of solutions to improve efficiency, reduce risk, and provide better services to customers. Here are some common AI and ML solutions used in financial services.

AI & ML SOLUTIONS FOR FINANCIAL SERVICES

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- **Fraud Detection and Prevention:** AI and ML models can analyze historical transaction data to detect unusual patterns or anomalies in real-time, helping prevent fraudulent activities such as credit card fraud, identity theft, and account takeovers.
- **Credit Scoring and Risk Assessment:** ML algorithms can assess credit risk by analyzing a broad range of data sources, including traditional credit history, non-traditional data (e.g., social media activity), and customer behavior. This helps financial institutions make more accurate lending decisions.
- **Algorithmic Trading:** AI-driven trading systems can analyze large datasets, news sentiment, and market trends to make high-frequency trading decisions, optimizing trading strategies and portfolio management.
- **Robo-Advisors:** Robo-advisors use ML algorithms to create and manage investment portfolios for clients based on their financial goals, risk tolerance, and market conditions. They offer automated, cost-effective investment advice.

AI & ML SOLUTIONS FOR FINANCIAL SERVICES

- **Customer Service and Chatbots:** Chatbots powered by AI can provide 24/7 customer support, answer inquiries, and assist with routine banking transactions, enhancing customer service while reducing operational costs.
- **Personalized Marketing:** AI can analyze customer data to create personalized marketing campaigns and product recommendations, improving cross-selling and upselling efforts.
- **Algorithmic Underwriting:** Insurance companies use ML algorithms to underwrite policies more accurately, assess risk, and set appropriate premiums based on individual characteristics.
- **Regulatory Compliance:** AI can assist in monitoring and ensuring compliance with financial regulations by analyzing vast amounts of data for suspicious activities and reporting any anomalies.
- **Predictive Analytics:** AI and ML can be used to predict market trends, customer behavior, and financial performance, helping financial institutions make informed decisions.

AI & ML SOLUTIONS FOR FINANCIAL SERVICES

- **Anti-Money Laundering (AML):** AI and ML models can help detect money laundering activities by analyzing transaction data and identifying unusual patterns or behavior.
- **Voice and Speech Recognition:** AI-driven voice recognition technology can enhance security and simplify customer authentication processes in call centers and mobile apps.
- **Loan Approval:** AI and ML can streamline loan approval processes by assessing the creditworthiness of applicants and automating decision-making.
- **Portfolio Management:** AI-driven portfolio management tools can optimize asset allocation, rebalancing, and risk management for investment portfolios.
- **Blockchain and Cryptocurrency Analysis:** AI can be used to analyze blockchain data for fraud detection, transaction monitoring, and cryptocurrency trading strategies.
- **Market Sentiment Analysis:** AI models can analyze social media, news, and other sources to gauge market sentiment, which can be valuable for trading and investment decisions.

AI & ML SOLUTIONS FOR FINANCIAL SERVICES

These AI and ML solutions are continually evolving as the financial services industry embraces technological advancements and big data. They help financial institutions streamline their operations, improve customer experiences, and make data-driven decisions while managing risks and compliance.

AI & ML SOLUTIONS FOR FINANCIAL SERVICES

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KEY TERMINOLOGY & SOFTWARE RELATED TO BANKING

The banking industry has its own set of key terminology and software tools that are critical for its operation. Here's an overview of some common terms and software related to banking.

KEY TERMINOLOGY & SOFTWARE RELATED TO BANKING

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- **Deposit Account:** An account where customers can deposit money, such as savings accounts, checking accounts, and certificates of deposit (CDs).
- **Interest Rate:** The rate at which a bank pays interest to depositors or charges borrowers for loans.
- **Loan:** Funds provided to borrowers with the expectation of repayment with interest over a specified period.
- **Credit Score:** A numerical representation of a person's creditworthiness, used by banks to assess loan eligibility and interest rates.
- **Mortgage:** A loan used to purchase real estate, with the property serving as collateral.
- **ATM (Automated Teller Machine):** A self-service machine that allows customers to perform banking transactions, including cash withdrawals and deposits.
- **Online Banking:** Internet-based services that enable customers to access their bank accounts, transfer funds, pay bills, and more.
- **Mobile Banking:** Banking services accessible through mobile apps, allowing customers to manage their accounts from their smartphones or tablets.

KEY TERMINOLOGY

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- **ACH (Automated Clearing House):** An electronic network used for processing financial transactions, including direct deposits, electronic bill payments, and fund transfers.
- **KYC (Know Your Customer):** A process used by banks to verify the identity and risk profile of their customers to prevent fraud and money laundering.
- **SWIFT (Society for Worldwide Interbank Financial Telecommunication):** A messaging network used for securely transmitting financial transaction information between financial institutions.
- **Fintech (Financial Technology):** Companies that use technology to provide financial services and products, often in innovative and digital ways.
- **Core Banking System:** The primary software system that manages a bank's customer accounts, transactions, and financial records.
- **Credit Union:** A financial institution that provides financial services similar to a bank but is typically owned by its members.
- **Investment Banking:** A division of a bank that offers financial advisory services and facilitates the issuance of securities and mergers and acquisitions.

KEY TERMINOLOGY

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01

CORE BANKING SOFTWARE

These systems manage customer accounts, transactions, loans, and other banking operations. Examples include FIS, Fiserv, and Temenos.

02

MOBILE BANKING APPS

Mobile apps provided by banks for customers to access their accounts, make transactions, and manage finances from their smartphones.

03

ONLINE BANKING PLATFORMS

Web-based portals that allow customers to access their accounts, make transfers, pay bills, and view account statements.

04

PAYMENT PROCESSORS

Companies like PayPal, Stripe, and Square facilitate electronic payments and financial transactions.

05

ATM SOFTWARE

Software that operates and manages the functionality of Automated Teller Machines.

COMMON BANKING SOFTWARE

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06

CUSTOMER RELATIONSHIP MANAGEMENT (CRM) SOFTWARE

CRM systems help banks manage customer information, interactions, and improve customer service.

07

ANTI-MONEY LAUNDERING (AML) SOFTWARE

Tools that help banks comply with AML regulations and detect suspicious transactions.

08

DATA ANALYTICS AND BUSINESS INTELLIGENCE SOFTWARE

Tools for analyzing customer data, financial trends, and making informed business decisions.

09

RISK MANAGEMENT SOFTWARE

These systems assist banks in identifying, assessing, and mitigating risks associated with their operations.

10

BLOCKCHAIN PLATFORMS

Some banks explore blockchain technology for secure and transparent record-keeping, especially in areas like international payments.

COMMON BANKING SOFTWARE

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The banking industry relies heavily on software to manage operations, improve customer service, and ensure regulatory compliance. These tools help banks deliver a wide range of financial products and services to their customers efficiently and securely.

COMMON BANKING SOFTWARE

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MACHINE LEARNING PIPELINE & WORKFLOW

A Machine Learning (ML) pipeline and workflow are structured processes that data scientists and machine learning engineers follow to develop, deploy, and maintain machine learning models.

These processes help ensure that the ML models are built efficiently, accurately, and can be deployed effectively in real-world applications.

MACHINE LEARNING PIPELINE & WORKFLOW

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MACHINE LEARNING PIPELINE

DATA COLLECTION

This is the initial step where raw data is gathered from various sources. Data can include structured data (e.g., databases) and unstructured data (e.g., text, images).

DATA PREPROCESSING

Raw data is often noisy, incomplete, or inconsistent. In this step, data is cleaned, transformed, and formatted to make it suitable for analysis. This includes handling missing values, encoding categorical variables, and scaling features.

FEATURE ENGINEERING

Engineers create new features or select relevant features from the dataset to improve the model's performance. Feature engineering can involve creating interaction terms, extracting important information from text or images, or generating domain-specific features.

DATA SPLITTING

The dataset is divided into training, validation, and testing sets. Training data is used to train the model, validation data helps in tuning hyperparameters, and the testing data is reserved for evaluating the final model's performance.

MODEL SELECTION

Data scientists choose the type of machine learning model (e.g., regression, decision tree, neural network) that is most suitable for the task at hand based on the problem's nature and the dataset.

HYPERPARAMETER TUNING

Data scientists perform hyperparameter optimization to fine-tune the model's settings, such as learning rates, regularization strength, and architecture complexity, to maximize performance.

MODEL TESTING

The final model is evaluated on the testing dataset to estimate its generalization performance and ensure it doesn't overfit the training data.

MONITORING AND MAINTENANCE

After deployment, the model's performance is continuously monitored. If its performance degrades over time or due to concept drift, retraining or reevaluation may be necessary.

MODEL TRAINING

Using the training data, the selected model is trained to learn the underlying patterns in the data. This process involves finding the optimal model parameters.

MODEL EVALUATION

The model's performance is assessed using the validation dataset, often through metrics such as accuracy, precision, recall, and F1-score. This step helps in selecting the best-performing model.

MODEL DEPLOYMENT

Once the model is deemed suitable, it is deployed into a production environment where it can make predictions on new, unseen data. This may involve creating APIs or integrating the model with existing systems.

A machine learning workflow extends beyond the pipeline to cover the end-to-end process, including planning and maintenance:

MACHINE LEARNING WORKFLOW

Problem Definition

In this initial phase, the problem is clearly defined, and project goals are established. It's essential to determine what success looks like and how the model will provide value.

Data Collection and Exploration

Data collection and exploration are the first steps in the workflow, involving gathering data and understanding its characteristics, quality, and relevance to the problem.

Data Preparation

Data is cleaned, preprocessed, and transformed to make it suitable for analysis.

Feature Engineering

Engineers create or select relevant features to improve model performance.

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A machine learning workflow extends beyond the pipeline to cover the end-to-end process, including planning and maintenance:

Model Building and Evaluation

Models are developed, evaluated, and tuned iteratively.

Deployment

The model is deployed in a real-world setting.

Monitoring and Maintenance

Continuous monitoring and maintenance of the model ensure it remains accurate and up-to-date.

Reassessment and Reiteration

As the model operates, feedback from real-world usage can be used to assess its performance, potentially leading to reiteration of steps in the workflow.

MACHINE LEARNING WORKFLOW

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Both the pipeline and workflow are essential for developing effective machine learning solutions. A well-structured workflow ensures that the problem is understood, data is prepared properly, and the deployed model remains relevant and accurate in the long term. The pipeline, on the other hand, focuses on the specific steps involved in model development and deployment.

MACHINE LEARNING PIPELINE & WORKFLOW

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ASSIGNMENT #01

DUE DATE:

June 25, 11:59 PM ET

GRADE:

5 points

AI/ML & FINANCIAL SERVICES TYPEFORM

Goal: Reflect on the first lesson through a short quiz on concepts covered in class.

Description: Complete the Typeform Quiz to reflect on the lesson.

Submission Guidelines: Take a screenshot of your final results and attach it to your submission.

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Q&A

WE ENCOURAGE YOU TO ASK QUESTIONS, HOWEVER, BE MINDFUL OF YOUR AND YOUR PEERS' TIME. KEEP YOUR QUESTIONS SHORT AND CONCISE.

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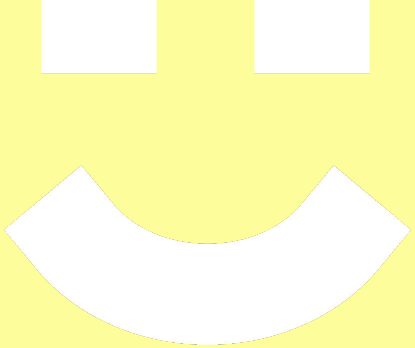

DID YOU ENJOY THE CLASS?

PLEASE TAKE A MOMENT TO COMPLETE A SHORT SURVEY AT THE END OF THIS SESSION. YOUR FEEDBACK WILL HELP US IMPROVE YOUR LEARNING EXPERIENCE.

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