

# Foundations of AI for Business Leaders

## Chief AI Officer Program

Vadim Sokolov

2025-12-18

### Table of contents

TOPIC PURPOSE . . . . .	2
TOPIC OVERVIEW . . . . .	2
TOPIC OBJECTIVES . . . . .	2
COURSE APPROACH . . . . .	3
TIME COMMITMENT . . . . .	3
SCHEDULE . . . . .	3
DISCUSSION BOARDS . . . . .	4
Discussion Board 1: Decision-Making Under Uncertainty . . . . .	4
Discussion Board 2: Predictive Models in Business . . . . .	4
Discussion Board 3: AI Agents in the Enterprise . . . . .	5
LIVE ZOOM SESSIONS . . . . .	5
Zoom Session 1: Kick-off + Cursor Hands-on . . . . .	5
Zoom Session 2: Mid-point Check-in . . . . .	6
Zoom Session 3: Wrap-up + Final Project Presentations . . . . .	6
ASSIGNMENT: Final Project . . . . .	6
Orange Juice Pricing Analytics Agent . . . . .	6
READING MATERIALS . . . . .	7
Module 1: Probability as a Language of Uncertainty . . . . .	7
Module 2: Statistics and Modeling . . . . .	8
Module 3: Modern AI . . . . .	9

**Online:** 2 Weeks (14 Days)

**Email:** vsokolov@gmu.edu

**Phone:** 703 993 4533

## TOPIC PURPOSE

The purpose of this topic is to introduce participants to the foundational concepts of artificial intelligence and data-driven decision making. Participants will develop a working understanding of probability, statistical modeling, and modern AI techniques—equipping them to lead AI initiatives, evaluate AI investments, and communicate effectively with technical teams.

---

## TOPIC OVERVIEW

This module takes executives on a journey from the fundamentals of probability and uncertainty through statistical modeling to the cutting edge of modern AI. Rather than focusing on mathematical derivations, we emphasize intuition, real-world applications, and business implications. Through compelling case studies—from wrongful convictions caused by probability errors to the Netflix Prize’s lessons about model complexity—participants will learn to think probabilistically about business decisions. The module culminates in a hands-on project where participants build an AI agent using Cursor IDE, directly experiencing how data, models, and AI agents work together to solve business problems.

---

## TOPIC OBJECTIVES

Upon completion of this topic, you should understand and be able to:

- Apply probabilistic thinking to business decisions under uncertainty
  - Recognize common probability fallacies (prosecutor’s fallacy, base rate neglect) and their business implications
  - Understand the trade-offs between model accuracy, complexity, and business value
  - Interpret regression models and explain their predictions to stakeholders
  - Evaluate when AI/ML solutions are appropriate versus traditional statistical approaches
  - Build a simple AI agent that combines data analysis with natural language interaction
  - Lead informed conversations with data science and AI teams
-

## COURSE APPROACH

This topic combines asynchronous learning (recorded lectures, readings, discussion boards) with synchronous sessions (live Zoom calls) and hands-on practice. The approach emphasizes:

- **Case-based learning:** Each concept is grounded in real-world examples—from legal cases to sports analytics to retail pricing
- **Business-first perspective:** Technical concepts are always connected to business decisions and outcomes
- **Progressive building:** Each module builds on the previous, culminating in an integrated final project
- **Peer learning:** Discussion boards encourage sharing experiences and learning from diverse industry perspectives
- **Applied practice:** The final project provides hands-on experience building an AI-powered analytics tool

---

## TIME COMMITMENT

This topic will require approximately **10 hours** of work to complete:

Activity	Hours
Recorded Lectures (6 lectures $\times$ 45 min)	4.5
Live Zoom Sessions (3 sessions $\times$ 1 hr)	3.0
Reading	1.5
Discussion Boards	1.0
Final Project	2.0
<b>Total</b>	<b>12.0</b>

---

## SCHEDULE

Day	Activities
<b>Day 1-2</b>	Module 1 lectures available; begin readings on probability and Bayes rule
<b>Day 3</b>	Discussion Board 1 opens

Day	Activities
<b>Day 4</b>	<b>Zoom Session 1:</b> Kick-off + Cursor IDE Hands-on (1 hr)
<b>Day 5-6</b>	Module 2 lectures available; readings on statistics and regression
<b>Day 7</b>	Discussion Board 2 opens
<b>Day 8</b>	<b>Zoom Session 2:</b> Mid-point Check-in (1 hr)
<b>Day 9-10</b>	Module 3 lectures available; readings on NLP and AI agents
<b>Day 11</b>	Discussion Board 3 opens
<b>Day 12-13</b>	Final Project work time
<b>Day 14</b>	<b>Zoom Session 3:</b> Wrap-up + Final Project Presentations (1 hr)

---

## DISCUSSION BOARDS

### Discussion Board 1: Decision-Making Under Uncertainty

*Opens Day 3 / Due Day 7*

“Consider a strategic decision your organization recently faced (or is currently facing) involving uncertainty. Describe the decision and identify:

1. What were the key uncertain factors?
2. How was probability or likelihood assessed (formally or informally)?
3. Reflecting on the Ellsberg paradox and Kelly criterion, how might a more systematic probabilistic approach have changed the decision-making process?

Respond to at least two peers’ posts with constructive suggestions.”

---

### Discussion Board 2: Predictive Models in Business

*Opens Day 7 / Due Day 11*

“The Netflix Prize awarded \$1 million for a 10% improvement in recommendation accuracy, yet Netflix never fully implemented the winning algorithm—it was too complex and expensive to deploy, and by then, streaming had changed the business model entirely.

Reflecting on this case and the regression concepts from this module:

1. Identify a business process in your organization where a predictive model could be applied. What decisions would it inform?
2. What would happen if the model's predictions were inaccurate 20% of the time? 40% of the time? How would this affect business outcomes and trust in the system?
3. Discuss the trade-off: Is a highly accurate but complex/expensive model always better than a simpler, 'good enough' model? What factors would you consider when making this decision?

Respond to at least two peers' posts, particularly focusing on whether you agree with their assessment of the accuracy-complexity trade-off."

---

### **Discussion Board 3: AI Agents in the Enterprise**

*Opens Day 11 / Due Day 14*

"AI agents are increasingly being deployed in business contexts. Describe a workflow or process in your organization that could potentially be automated or augmented by an AI agent. Address:

1. What tasks would the agent perform?
2. What data or tools would it need access to?
3. What guardrails or human oversight would be necessary?
4. What risks or concerns would need to be addressed before deployment?

Respond to at least two peers' posts."

---

## **LIVE ZOOM SESSIONS**

### **Zoom Session 1: Kick-off + Cursor Hands-on**

*Day 4 / 1 hour*

- Welcome and module overview (15 min)
- Hands-on: Setting up Cursor IDE and using coding agents (30 min)
- Q&A on probability concepts from Module 1 (15 min)

**Preparation:** Install Cursor IDE before the session (instructions provided in `cursor-setup-guide.md`)

---

## Zoom Session 2: Mid-point Check-in

*Day 8 / 1 hour*

- Review of statistical modeling concepts (20 min)
- Live demo: Building a simple regression model with Cursor (25 min)
- Discussion of final project requirements (15 min)

**Preparation:** Complete Module 2 lectures and readings

---

## Zoom Session 3: Wrap-up + Final Project Presentations

*Day 14 / 1 hour*

- Brief Modern AI recap (10 min)
- Final project presentations/demonstrations (35 min)
- Course wrap-up and next steps for AI leadership (15 min)

**Preparation:** Complete final project; prepare 2-3 minute demonstration

---

## ASSIGNMENT: Final Project

### Orange Juice Pricing Analytics Agent

**Business Problem:** You are a pricing analyst at a retail chain. Management wants to optimize orange juice pricing and promotional strategies. Build an AI agent that can answer business questions about pricing decisions using historical sales data and a predictive model.

**Dataset:** Dominick's Orange Juice Dataset

- Weekly sales data for orange juice brands (Tropicana, Minute Maid, Dominick's)
- Variables: sales volume, price, advertising features, brand
- ~28,000 observations across multiple stores

**Model:** Linear Regression with Interactions

- Predict sales volume based on price, advertising, and brand
- Capture how price sensitivity varies by brand

### **Your Agent Must Answer These Business Questions:**

1. “What is the predicted sales volume if we price Tropicana at \$2.50 with no advertising?”
2. “Which brand is most price-sensitive?”
3. “Should we feature Minute Maid in this week’s ad circular? What’s the expected sales lift?”
4. “What price should we set for Dominick’s brand to maximize revenue?”
5. “Compare the price elasticity across the three brands.”

### **Deliverables:**

1. Python code files in Cursor IDE (using provided template)
2. Working agent that answers the 5 business questions above
3. 1-page summary: What did you learn about OJ pricing? What surprised you?
4. 2-3 minute demo during Zoom Session 3

### **Evaluation Criteria:**

- Functionality: Agent loads data, builds model, and responds to queries
- Business Relevance: Clear connection between model outputs and business decisions
- Documentation: Clear explanation of approach and results

See [Final Project Guide](#) for detailed step-by-step instructions.

---

## **READING MATERIALS**

### **Module 1: Probability as a Language of Uncertainty**

#### **Required Reading (from course textbook):**

##### *Chapter 1: Probability and Uncertainty*

- Opening sections through “Kolmogorov Axioms”
- Section: “Conditional, Marginal and Joint Distributions”
- Example: Salary-Happiness

##### *Chapter 2: Bayes Rule*

- Section: “Intuition and Simple Examples”
- Example: Sally Clark Case
- Example: Nakamura’s Alleged Cheating

##### *Chapter 4: Utility, Risk and Decisions*

- Section: “Expected Utility”
- Examples: Saint Petersburg Paradox, Kelly Criterion, Ellsberg Paradox
- Section: “Decision Trees” (including Medical Testing and Mudslide examples)

**Supplemental Reading (online):**

- [Did a US Chess Champion Cheat?](#) - Chicago Booth Review (Bayesian analysis, prosecutor’s fallacy)
  - [A Refresher on Statistical Significance](#) - Harvard Business Review
  - [Decision Making in Uncertain Times](#) - McKinsey
- 

**Module 2: Statistics and Modeling**

**Required Reading (from course textbook):**

*Chapter 1: Probability and Uncertainty*

- Sections: “Normal Distribution,” “Poisson Distribution,” “Binomial Distribution”
- Examples: Heights of Adults, Customer Arrivals, NFL Patriots Coin Toss

*Chapter 3: Bayesian Learning*

- Section: “Poisson Model for Count Data”

*Chapter 12: Linear Regression*

- Section: “Linear Regression” (opening)
- Examples: Google vs S&P 500, Orange Juice

*Chapter 13: Logistic Regression and GLMs*

- Sections: “Model Fitting,” “Confusion Matrix,” “ROC Curve”
- Example: NBA point spread

**Supplemental Reading (online):**

- [The Surprising Power of Online Experiments](#) - Harvard Business Review (A/B testing)
  - [Machine Learning Explained](#) - MIT Sloan
  - [Why Even a Million Dollars Couldn’t Buy a Better Algorithm](#) - Wired (Netflix Prize case study)
-



### **Module 3: Modern AI**

#### **Required Reading (from course textbook):**

*Chapter 24: Natural Language Processing*

- Sections: “Converting Words to Numbers (Embeddings),” “Word2Vec and Distributional Semantics”
- Example: Word2Vec for War and Peace
- Sections: “Attention Mechanisms,” “Transformer Architecture” (overview)

*Chapter 26: AI Agents*

- Full chapter overview (agent architecture, tool use, planning, safety)

#### **Supplemental Reading (online):**

- [Making the Most of AI and Machine Learning in Organizations](#) - Stanford SMJ Paper
- [Traditional Statistics vs Machine Learning](#) - ToolsGroup
- [The State of AI in 2024](#) - McKinsey
- [Generative AI's Act Two](#) - Sequoia Capital