

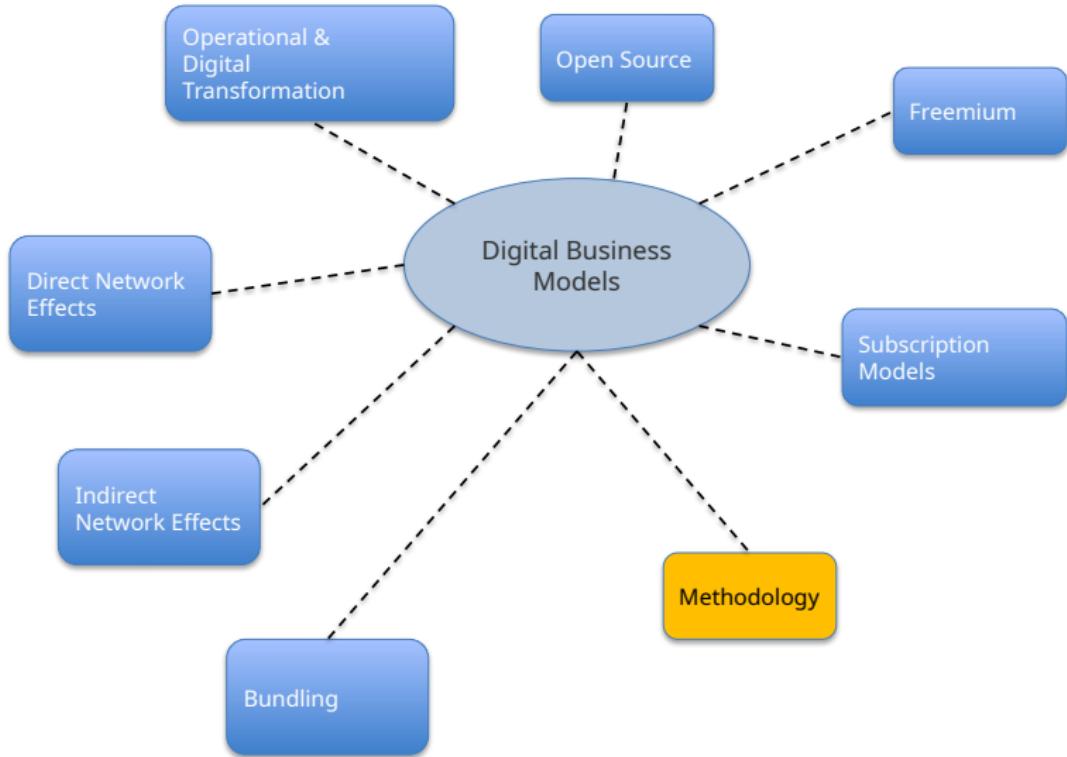
Research and Teaching Overview

Vineet Kumar

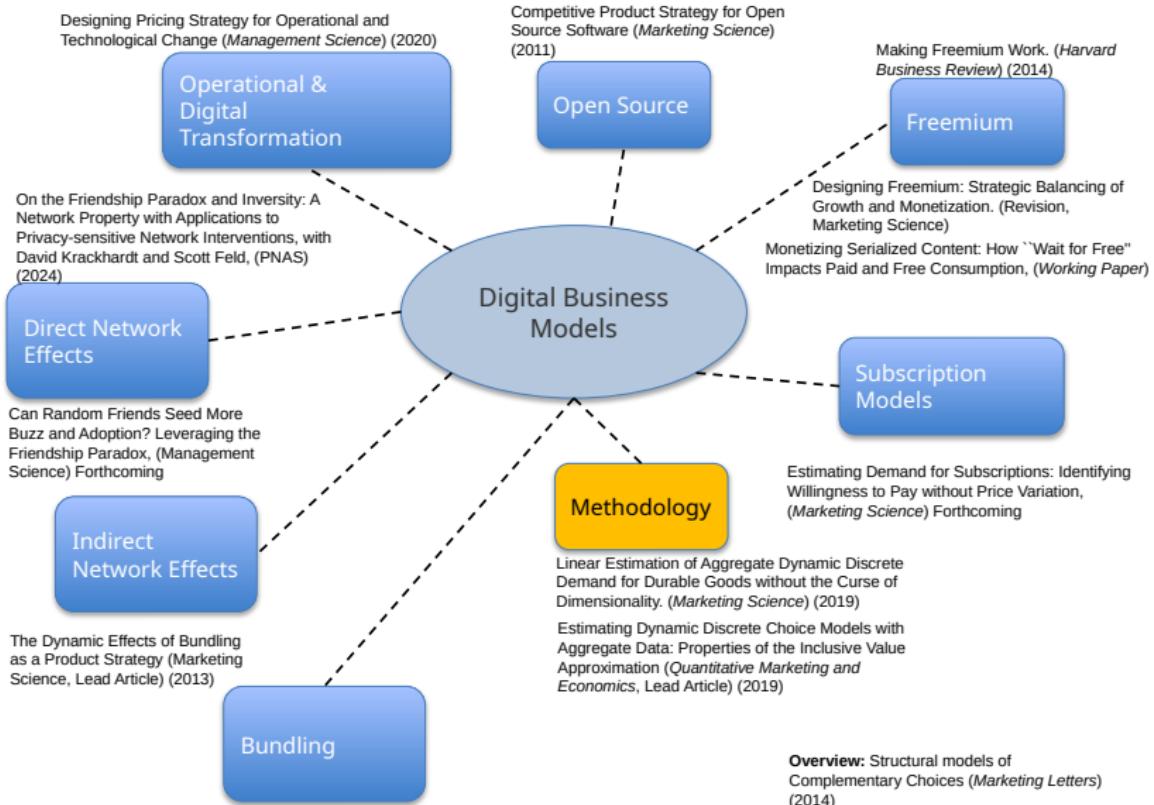
Yale School of Management

Presenting at:
Virginia Tech Virtual Meeting
August 2025

Research Overview

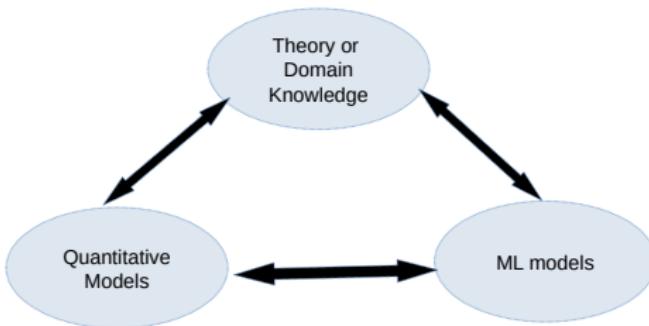


Digital Economy – Business Models



Role of Human Knowledge in Research

ML has typically been atheoretical



- One view of ML – advanced form of *statistical pattern matching*
 - Similar model (CNN) used both for detecting lung cancer (medicine) and for detecting stars (astronomy)

My Take

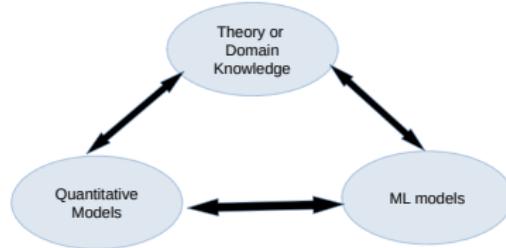
Our **domain knowledge (theory)** has a lot to add

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Why add domain knowledge?

Can improve predictive *accuracy*, *explainability*, provide *guarantees*



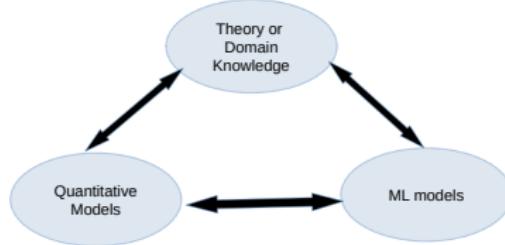
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- A Theory-Based Explainable Deep Learning Architecture for Music Emotion. *Marketing Science* 44 (1), 196-219



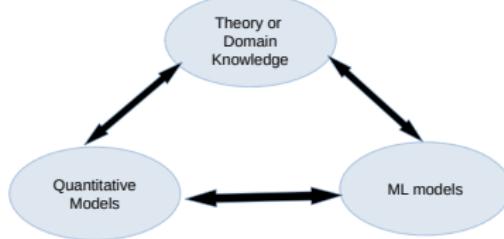
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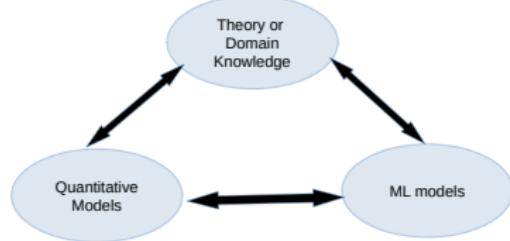


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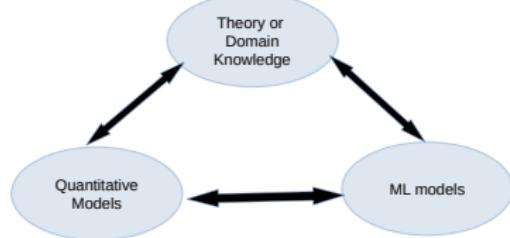
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- Nonparametric Bandits Leveraging Informational Externalities to Learn the Demand Curve. Forthcoming at *Marketing Science*
- Market Structure Mapping with Visual Characteristics. (Research in progress)

Generative Interpretable Visual Design

Presenting at:
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Visual (or aesthetic) design matters across many product categories . . .



Cars

Visual (or aesthetic) design matters across many product categories . . .



Cars



Fashion

Visual (or aesthetic) design matters across many product categories . . .



Cars



Fashion



Furniture

Consumer Preferences for Visual Design



Demand Estimation: Big Picture

Goal:

Obtain consumer preferences for visual design (conjoint or market data)

Demand Estimation for Products in Differentiated Product Markets in Economics and Marketing

- Builds on foundation of Lancaster (1966), Kotler (1967)

Demand Estimation: Big Picture

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What about preferences in visual space?

Cannot do this because characteristics for visual design are unknown!

What this research seeks to do

Research Goals

Obtain **human-interpretable** visual characteristics (not outliers) directly from unstructured product image data:

- *automatically discover and extract characteristics for products*

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Hyundai: (3, 8, 5, 9) compared to BMW: (1, 3, 10, 1)

Research Goals

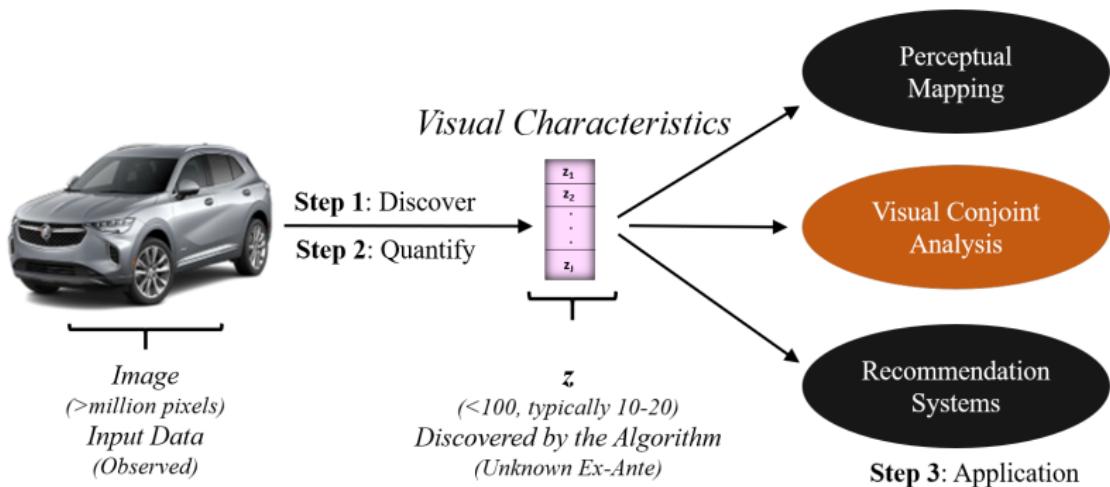


Hyundai: (3, 8, 5, 9) compared to BMW: (1, 3, 10, 1)

Several questions come to mind:

- What does the first number represent? Does 3 mean something different from 1?
- Can humans interpret these numeric values?

Research Goals



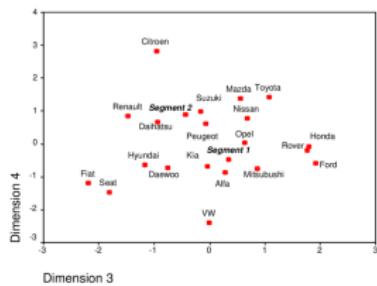
Market Structure Mapping with Interpretable Visual Characteristics

Presenting at:
Virginia Tech Virtual Meeting
August 2025

What is a Market Structure Map?

A common element of market structure analysis is the derivation of a **market structure map**, that is, a spatial representation of firms' competitive positions relative to one another based on some measure of their competitive relationships (DeSarbo et al. 1993)

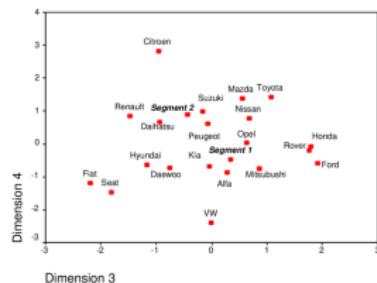
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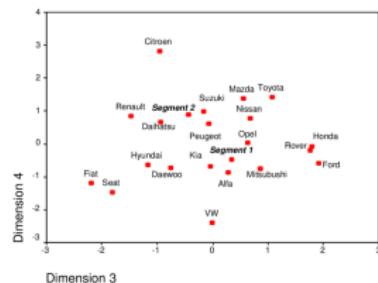
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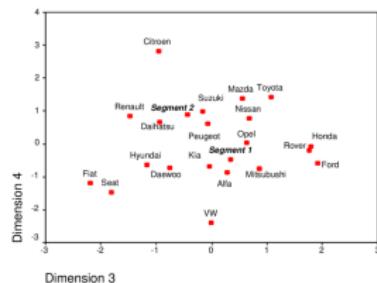
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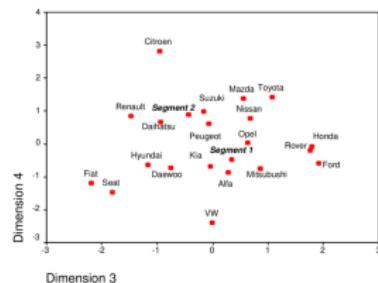
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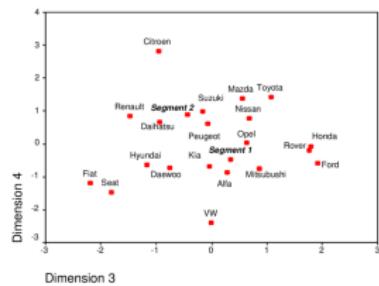
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 - **Identify competitors and evaluate positioning**



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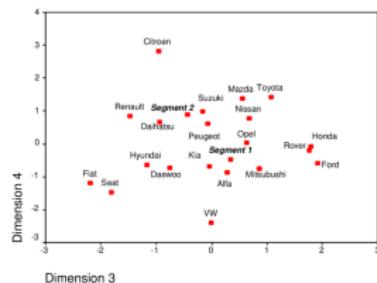
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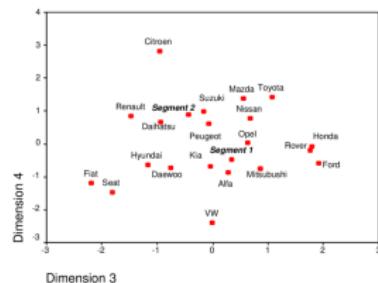
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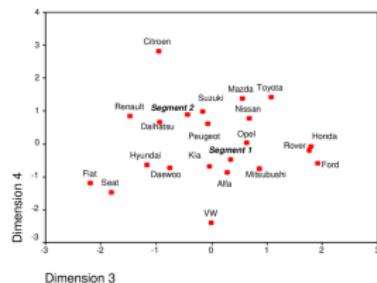
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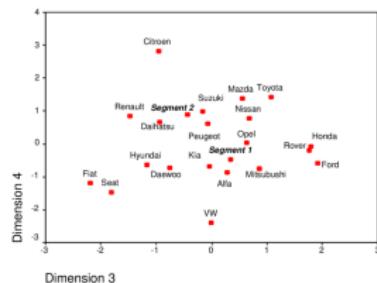
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Are these cars close substitutes?

First, consider *functional* product characteristics:

(A)

\$179,000-\$243,000, 553 HP,
16-23 MPG

(B)

From \$242,700, 542-650 HP,
14-22 MPG

Are these cars close substitutes?

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Ferrari California



(B)

From \$242,700, 542-650 HP,
14-22 MPG

Bentley Continental GT



Importance of Visual Design

Functional characteristics alone are *not sufficient* to even place the car in an appropriate segment (submarket)

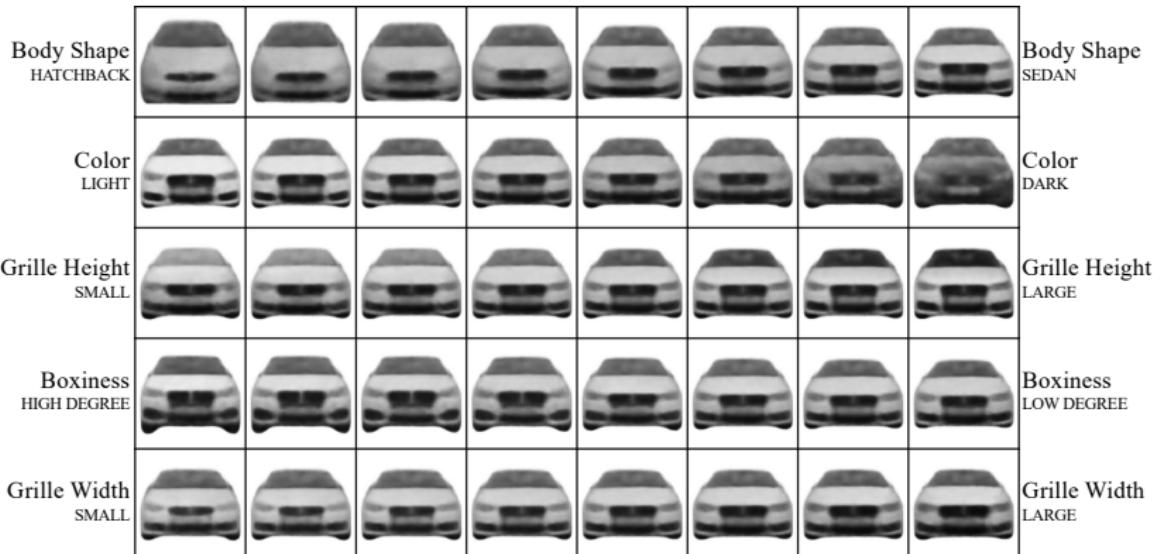
Visual design matters



“Exterior look/design is the top reason shoppers avoid a particular vehicle (30%), followed by cost (17%).”

—JD Power Avoider Study 2015

Disentanglement obtains four interpretable visual characteristics

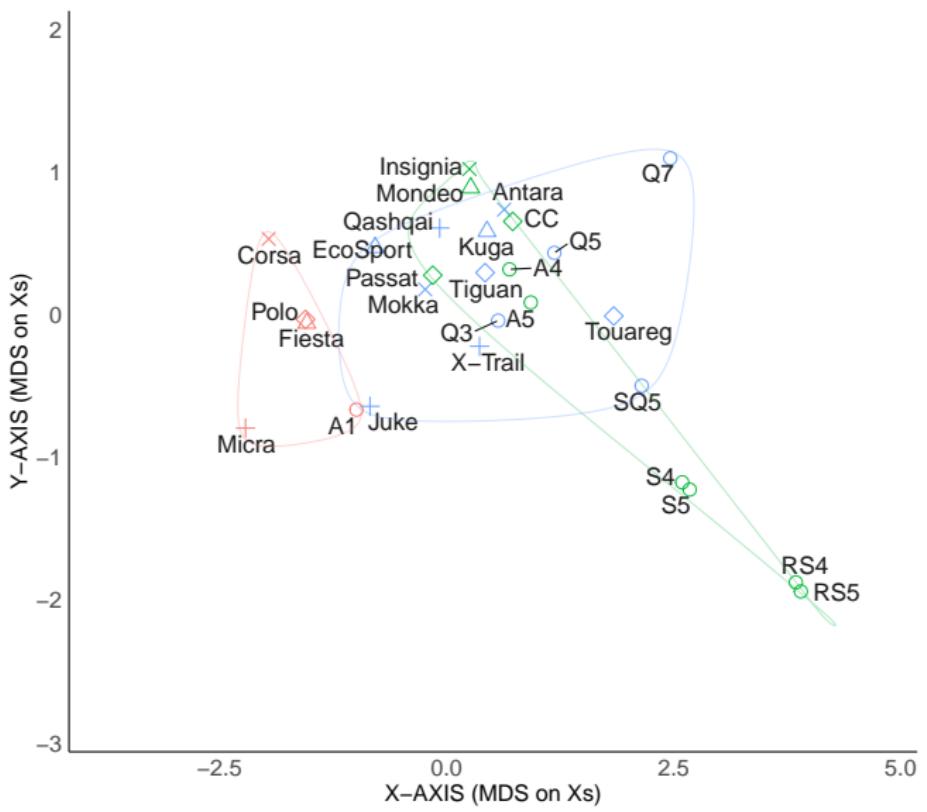


Left to Right: Vary one visual characteristic, keeping all others fixed

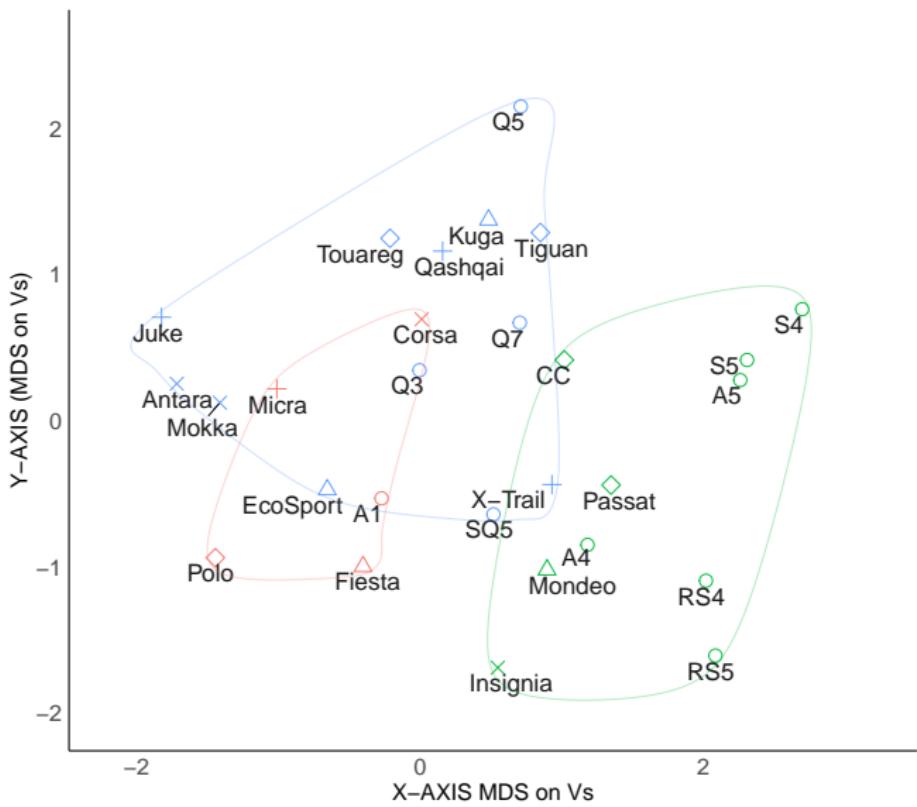
Segments in the UK automobile market

Segment	Description				
A	Minicars		Seg A (Minicar)		
B	(Subcompact)		Seg B (Subcompact)		
C	Compact		Seg C (Compact)		
D	Mid-size		Seg D (Mid-Sized)		
E	Mid-size Luxury		Seg E (Mid-Sized Luxury)		
J	SUV		Seg J (SUV)		
M	MPV		Seg M (MPV)		

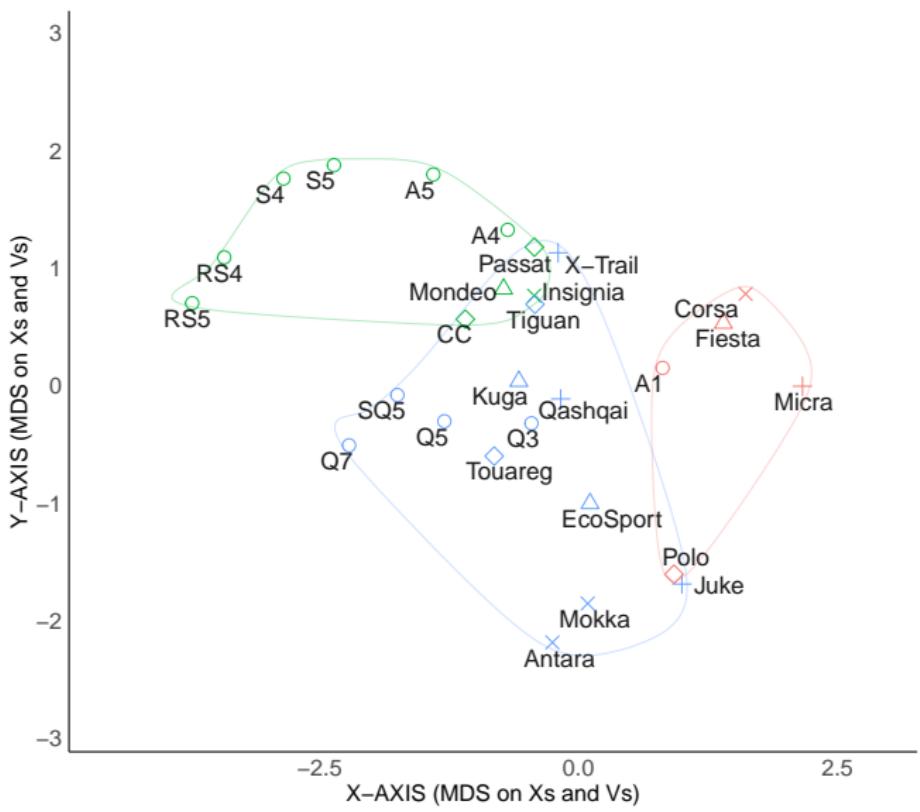
Market Structure Map (Functional Only)



Market Structure Map (Visual Only)



Market Structure Map (Functional + Visual)



Teaching Overview

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My Teaching Philosophy

- Start by asking questions

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 - Socratic approach to develop critical thinking

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 - We often learn more from “mistakes” than “correct answers”
- Small breakout groups for discussions

AI Strategy and Marketing

Course Objectives

- Understand the basic foundations of AI and ML models

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- Develop a perspective regarding new emerging AI technologies and how they could reshape markets and firms
- Evaluate the broader societal implications of AI, and how different stakeholders (consumers, employees, firms, regulators, investors and others) are impacted by AI.

AI Strategy and Marketing

Course Outline

#	Date	Topic	Assignment Due (9 am)
Module A: AI Foundations			
1	Mar 25 (Tue)	Course Introduction and Supervised and Un-supervised Algorithms	
2	Mar 27 (Thu)	ML Essentials	
3	April 1 (Tue)	Deep Learning, Reinforcement Learning and Generative Models	A1 (Individual / Pairs)
Module B: AI Decision Making Framework			
4	April 3 (Thu)	Economics of AI \iff Business Strategy	
5	April 8 (Tue)	Decision Making with AI / Interpretable and Explainable AI	A2 (Individual)
6	April 10 (Thu)	Ethical Issues in AI	Group Project Proposal (one paragraph)
Module C: AI in Business + Society			
7	April 15 (Tue)	Uber (CASE)	A3 (Individual)
8	April 17 (Thu)	Zebra Medical (CASE)	
9	April 22 (Tue)	Generative AI in practice	A4 (Individual)
10	April 24 (Thu)	Miroglino Fashion (CASE)	
11	April 29 (Thu)	Capstone: Human Capital	
Module D: Project Presentations and Course Wrap			
12	May 1 (Thu)	Presentations	Presentation Slides Due for ALL groups on May 1
13	May 6 (Tue)	Presentations and Course Wrap	

Digital Strategy

Course Objectives

- Understand growth and monetization tradeoffs in adopting business models

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- Evaluate design decisions and governance mechanisms for platforms
- Investigate new emerging technologies and how they could reshape markets and firms
- **Understand challenges and opportunities involved in undertaking a digital transformation**

Digital Strategy

Course Outline

OUTLINE OF CLASS SESSIONS (All Dates 2023)

Session	Date	Topic	Assignment Due (Time Due: 9 am)
Module 1: Digital Strategy and Business Models			
1	Aug 31 (Thu)	Course Introduction Overview of Business Models	
2	Sep 05 (Tue)	Dropbox: It Just Works (CASE)	A1 (Individual)
Module 2: Disrupting and Complementing			
3	Sep 07 (Thu)	Entry in Existing Markets (Disruptors and Complementors)	
4	Sep 12 (Tue)	Apple Pay (CASE)	A2 (Individual)
5	Sep 14 (Thu)	Robinhood (CASE)	
6	Sep 19 (Tue)	Zillow and Redfin (Dual CASE Presentations)	A3 (Group Presentation, submit Slides on Canvas)
Module 3: Platform Thinking			
7	Sep 21 (Thu)	Platform Thinking	
8	Sep 26 (Tue)	American Well (CASE)	A4 (Individual)
9	Sep 28 (Thu)	Issues in Platform Design	
Module 4: Transformation through Technology			
10	Oct 03 (Tue)	Firm Transformation with Technology The New York Times Paywall (CASE)	A5 (Individual)
11	Oct 05 (Thu)	Blockchain (In-class Exercise)	
12	Oct X	Guest Lecture	
13	Oct 12 (Tue)	Overview of Emerging Technologies & Course Summary	

Project Proposal (Group) — 1-2 paragraphs due on Sep 15

Project Report (Group) — Slides Due on Oct 19