



Georgetown Data Science & Analytics (DSAN)

Capstone Project Concepts

08/20/2025

Georgetown University Collaboration Overview

Georgetown University's Data Science and Analytics (DSAN) program has reached out to Shift Digital to establish a strategic partnership for their Fall 2025 DSAN7000 Capstone Project course. This collaboration provides an opportunity for Shift to mentor graduate-level data science students while they complete substantive research projects aligned with real business challenges.

The Georgetown DSAN Capstone course follows a rigorous 15-week academic structure designed around the research publication process. Students work under joint supervision of Georgetown faculty and industry mentors, progressing through five key modules: Outline/Summary, Introduction/Literature Review, Methods, Results, and Discussion/Conclusion. Each module involves structured learning, individual mentored work, and peer presentation components.

The program emphasizes practical application of advanced data science methodologies while developing students' research and scientific writing capabilities. Students are required to produce independent research projects culminating in a final research paper and poster presentation to faculty and industry mentors in December 2025.

As an industry mentor, Shift Digital would provide domain expertise and project guidance to two graduate students pursuing distinct but complementary research directions. The collaboration aligns with Georgetown's requirement for industry partnerships that bridge academic learning with practical business applications in data science and analytics.

Business Value & Benefits to Shift Digital

Immediate Benefits

- **Enhanced Model Performance:** Improved forecasting accuracy for better client recommendations and increased client satisfaction
- **Cost-Effective R&D:** Access to high-quality graduate-level research and analysis
- **Fresh Perspectives:** External academic viewpoint may identify opportunities or approaches internal teams haven't considered

Strategic Benefits

- **Scalable Methodology:** Research outcomes can be applied across Shift's client portfolio
- **Product Development Pipeline:** Student findings could inform future feature development initiatives
- **Talent Pipeline:** Opportunity to evaluate and potentially recruit top-tier data science talent
- **Academic Partnership:** Strengthens Shift's relationship with Georgetown's DSAN program for future collaborations

Risk Mitigation

- **Knowledge Transfer:** Comprehensive documentation ensures findings remain valuable beyond the project timeline
- **Parallel Development:** Projects run alongside existing internal work, minimizing business disruption
- **Controlled Data Access:** Use of anonymized/aggregated data protects client confidentiality while enabling meaningful analysis

Project Concept 1: Sales Forecasting Model Enhancement

Project Focus: Improving Sales Prediction for Different Business Types and Data Challenges

Background: Shift Digital's sales forecasting system creates detailed prediction models at the store-model-day level, generating thousands of individual forecasts per client. The system works well for standard clients but faces challenges with highly seasonal businesses where sales patterns differ dramatically (e.g. strong spring/summer, weak fall/winter). Additionally, the system struggles with sparse data situations where individual stores may sell very few units of specific models per month. The challenge is optimizing forecasting approaches for different business types while focusing on digital marketing factors that stores can control.

Student Objectives

- Analyze forecasting performance differences between seasonal and non-seasonal business types
- Investigate techniques for handling sparse sales data at the store-model level where stores may sell only a few units per month
- Research forecasting model optimization approaches (hyperparameter tuning, alternative algorithms) to improve seasonal pattern recognition
- Focus on controllable marketing metrics rather than external economic factors
- Develop recommendations for model configuration based on business seasonality and data characteristics

Deliverables

- Analysis comparing forecasting accuracy across different business types
- Research on techniques for handling sparse sales data and preventing forecast inflation
- Testing results of different optimization approaches for seasonal vs non-seasonal forecasting
- Practical recommendations for model configuration based on business characteristics
- Final presentation demonstrating improved forecasting approaches for different client types

Skills Applied

- Data Analysis and Statistical Modeling
- Sales Forecasting Techniques
- Business Analytics
- Model Performance Evaluation
- Digital Marketing Analytics

Project Concept 2: Sales Target Decomposition Analytics

Project Focus: Developing Intelligent Store Benchmarking and Recommendation Prototype

Background: The team is exploring an innovative approach to generate actionable store recommendations by combining clustering analysis, predictive modeling, and recommendation algorithms. The concept involves grouping stores with similar operational characteristics, identifying top performers within each group and generating specific recommendations for improvement. This represents a new approach to move beyond traditional reporting toward prescriptive analytics that can provide stores with specific, actionable guidance on improving their performance.

As a potential extension of this work, there is interest in exploring an interactive "what-if" analysis component that would allow users to test different marketing scenarios. This conceptual addition would function like an interactive calculator with adjustable parameters, letting stores modify marketing variables to see predicted sales outcomes. The technical challenge would involve modeling the interconnected relationships between metrics - for example, how increasing marketing spend might cascade through various engagement metrics to impact sales predictions. This extension would depend on project progress and scope feasibility within the 12-week timeline.

Student Objectives

- Research and develop clustering methodologies for grouping stores by operational similarity
- Build predictive models to identify performance patterns within store groups
- Create recommendation algorithms that generate specific, actionable suggestions for store improvement
- Develop approaches for validating recommendation quality and ensuring recommendations are realistic and achievable
- If time and scope allow, explore interactive scenario modeling approaches for testing marketing variable relationships
- Research potential techniques (such as Markov chains) for modeling interconnected metric relationships as a conceptual foundation

Deliverables

- Store clustering methodology with validation of grouping effectiveness
- Recommendation generation system with specific, measurable suggestions
- Framework for ensuring recommendation feasibility and preventing unrealistic suggestions
- Validation approach for testing recommendation quality using historical performance data
- Prototype system demonstrating the benchmarking and recommendation workflow

Skills Applied

- Clustering Analysis and Segmentation
- Predictive Modeling
- Recommendation System Development
- Business Intelligence and Performance Analytics
- Data Validation and Quality Assurance
- Exploratory Research on Interactive System Design (scope permitting)

Tentative Project Tracking

Implementation Timeline

- **Weeks 1-2:** Literature review, data exploration and problem scoping
- **Weeks 3-6:** Core algorithm development and initial testing
- **Weeks 7-9:** Validation, refinement and performance analysis
- **Weeks 10-11:** Documentation and implementation guide creation
- **Week 12:** Final presentation and knowledge transfer

Success Metrics

- **Project 1:** Demonstrate measurable improvement in forecasting accuracy for seasonal business patterns
- **Project 2:** Create functional benchmarking system with validated recommendation quality scores
- **Combined Impact:** Produce actionable insights that support business intelligence goals

Data Access and Resources:

Students will work with anonymized datasets including historical sales performance, digital marketing metrics, website analytics and store operational characteristics. Technical mentorship will be provided throughout the project with regular check-ins to ensure successful completion within the academic timeline.

Project Scope and Expectations:

These projects focus on prototype development and methodology creation rather than full production systems. Students will emphasize research, analysis and proof-of-concept development with clear documentation for future implementation. The goal is to produce meaningful contributions to ongoing business intelligence initiatives while providing substantial learning experiences in applied data science.