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Quantifying Novelty & Value: A Data-Driven Framework for Automated Product Generation

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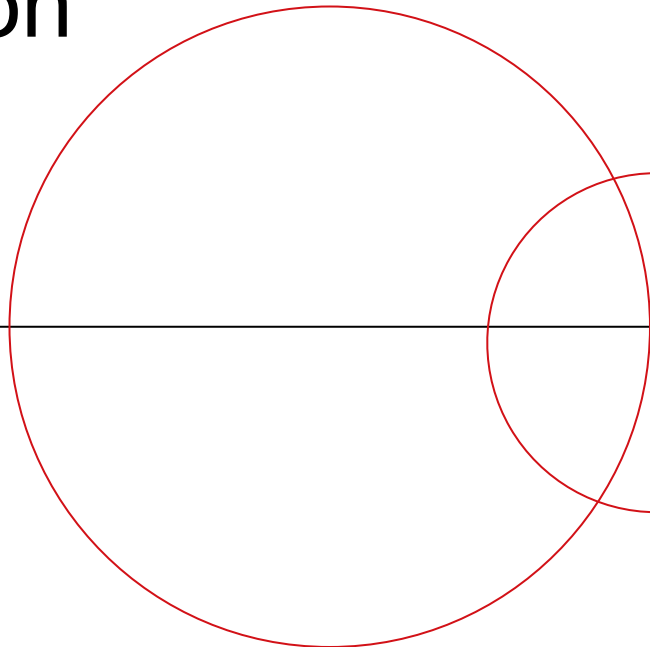

Team

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Agenda

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01 Problem & Interpretation

02 Key Insight

03 Framework Overview

04 Methodology

05 Results

06 Conclusion

Problem Statement & Initial Interpretation

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PROBLEM GIVEN

"A team of MSBA students will leverage AI and advanced analytics to generate innovation ideas, vet against existing research, predict business value, and prioritize for further realization."

KEY MESSAGE

Before solving the problem, we first needed to define how to structure and evaluate innovation itself

OUR INITIAL THOUGHTS

- Broad and open-ended problem with no predefined structure
- Spans multiple stages:

  generation → validation → evaluation → prioritization
- Requires integrating technical methods (AI/LLMs) with business judgment
- No clear definition of idea format, novelty measures, or business value quantification

Key Insight: Reframing the Problem

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The project shifted from an idea generation problem to an idea evaluation problem

INITIAL ASSUMPTION

Innovation **= Generating More Ideas**

- LLMs can produce ideas at scale (prompts)
- Volume alone does not create value

OUR REALIZATION

Innovation = **Understanding, Comparing and Prioritizing Ideas**

- Compare ideas consistently
- Detect repetition hidden by wording
- Focus on what is novel and useful

WHY THIS SHIFT MATTERS

Evaluation stays subjective without structure

False novelty wastes time

Better comparison improves decision quality

The core challenge is not creating ideas — but identifying which ideas are truly novel and valuable.

Framework Overview: How We Structure the Problem

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We designed a structured framework to transform unstructured patent data into evaluated innovation opportunities.

WHY THIS MATTERS

- Clarifies the full logic of the framework
- Shows how ideas become prioritized opportunites

Step 1: Structure Ideas

- Define a **common** idea format
- **Extract** core components from idea
- Make Ideas **comparable**

Structured idea Schema

Step 2: Create New Concepts

- Recombine useful **ingredients**
- Explore **cross-domain** possibilities
- **Generate** concept candidates

Ingredient Recombination

Step 3: Idea Evaluation

- Measure **novelty**
- Assess **business value**
- Support **prioritization**

Novelty + Value Scoring

A structured framework for moving from raw idea sources to strategic prioritization.

Measuring Novelty: A Multi-Dimensional Approach

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THE CHALLENGE

Novelty is difficult to define and often judged subjectively.

Our Approach: We quantify novelty across three dimensions of distance to "edit"

1. Recombination Distance

How different are the **components** being combined?

Captures cross-domain innovation.

2. Knowledge Origin Distance

How far the idea is from existing patent clusters.

Identifies white space opportunities.

3. Impact Distance

How much the idea shifts potential application or value.

Connects novelty to real-world relevance.

Quantifying novelty through multi-dimensional distance enables systematic innovation evaluation.

Standardizing Ideas: Structured Representation (PEMPSA)

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To compare ideas fairly, we first describe them in the same way

Our Approach: We represent each idea using a standardized schema (PEMPSA)

PEMPSA Schema

Field	Description
Problem	The core challenge the concept aims to resolve
Environment	The context in which the idea operates
Mechanism	How it addresses the problem
Physical Ingredients	The physical components involved
Source Domain	The technical domain of each component
Applicability	Other domains that it can be applied to

WHAT PEMPSA ENABLES

- Makes ideas comparable
- Helps detect repetition
- Support semantic novelty measurement

Standardizing representation enables consistent cross-domain idea evaluation and comparison.

How We Teach a Machine to Measure Novelty

Turning patents into structured, generated, and prioritized ideas

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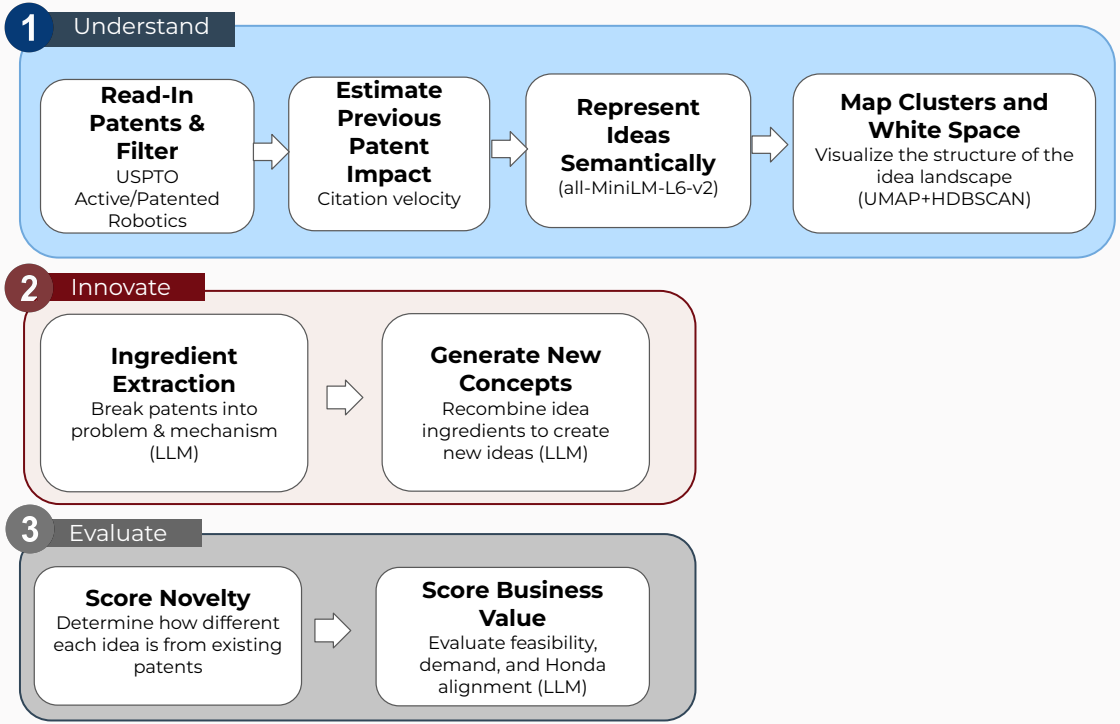

WHY IT MATTERS

- Compares Ideas by meaning, not just words
- Generates structured concepts combinations
- Supports novelty and value-priorization

PIPELINES OUTPUTS

- Patent Landscape map
- Generated concept candidates
- Novelty and value scores

A structured pipeline to understand, generate and evaluate innovation ideas.

Strategic Prioritization: Isolating High-Value Innovation

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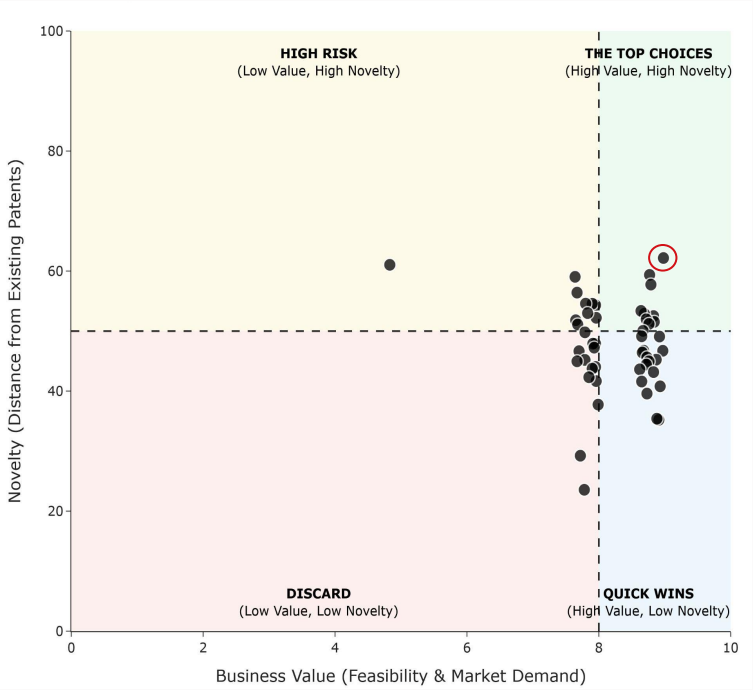

Pressure-Sensory Geofencing for Autonomous Machines

Problem: "Autonomous work machines working in a work area may inadvertently enter a no-work area"

Mechanism: "Using two pressure sensors to measure different positions along the seatback"

Novelty	Business Value
62.18	8.98

High feasibility using existing sensor tech, paired with high novelty in a new autonomous application.

Strategic Impact & Next Steps

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Strategic Shift

Transitions R&D from subjective brainstorming to mathematical white-space validation

Proves novelty can be scored objectively at the concept level

Current Limitations

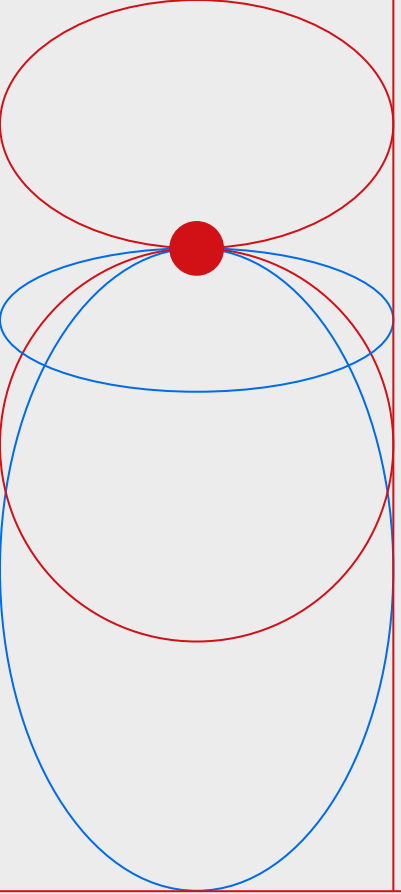
Business value scoring acts as a rigorous filter, but does not replace human engineers

Final "Top Choices" still require expert physical validation

Immediate Next Steps

Scale the framework to new engineering domains

Utilize the mapped historical patent database as a training set to build a supervised model, empirically validating our heuristic business value scores



Thank you

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