

Case Study L1-008

Semantic Precision in Patent NMT

Register Failure (The "Medical Mud" Incident)

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Case Study Metadata

Dataset ID: L1-008

Category: Semantic Precision — Level 1

Focus: Register Mismatch (Industrial vs. Medical)

Model: Generic NMT

Domain: MedTech / Thermodynamics

1 The Context: Slurry in Medicine

In medical thermodynamics, an **"Ice Slurry"** describes a phase-changing coolant composed of millions of micro-ice crystals suspended in a liquid carrier (usually saline). It is a fluid, sterile substance used to rapidly cool organs or blood. The correct technical term in French is **"Suspension"** or **"Coulis"**.

Key Concept

The Register Trap:

The term "Slurry" is heavily weighted in training data towards the **Construction** and **Mining** industries (Cement slurry, coal slurry, manure slurry). In these contexts, the standard French translation is **"Boue"** (Mud, Sludge, Mire). Generic models fail to suppress this "dirty" connotation when switching to a sterile medical context.

2 The Glitch: "Frozen Medical Mud"

In Claim 1, the generic model translated "Medical Ice Slurry" using the construction term, resulting in a grotesque description of the invention.

2.1 Forensic Evidence (Claim 1)

2.2 Why This Matters

- **Contradiction:** The claim asserts the product is "Sterile" while simultaneously calling it "Mud" (*Boue*). This creates a semantic paradox that could lead to rejection for indefiniteness.
- **Regulatory Failure:** A medical device label reading "Boue Médicale" would be rejected by the ANSM (French Health Agency) for misleading/improper terminology.

Source Term (English)	NMT Output (Hallucination)	Golden Rewrite (Correct)
"A sterile medical slurry..."	× "...Une boue médicale stérile..." (Meaning: Sterile Mud/Sludge)	"...Une suspension médicale stérile..." (Meaning: Sterile Suspension)

Table 1: Register Failure in Medical Claims

- **Consumer Trust:** The translation implies the injection of filth, destroying the commercial viability of the patent in French-speaking markets.

3 Alignment Methodology

3.1 Negative Terminology Constraints

To prevent this, we use a "Forbidden List" triggered by the domain.

Alignment Methodology

The Hygiene Protocol:

1. **Domain Detection:** Detect keywords [Sterile], [Medical], [Injecting], [Patient].
2. **Vector Blocking:**
 - IF Domain = MEDICAL:
 - **BLOCK:** *Boue, Vase, Gadoue* (Dirt-related terms).
 - **FORCE:** *Suspension* (Chemistry) or *Coulis* (Fluid dynamics).
3. **Oscillation Prevention:** Ensure the term remains consistent. The model initially used "Boue", then switched to "Suspension" in Claim 10. The protocol forces "Suspension" globally.

4 Key Insights

Key Concept

What This Case Study Demonstrates:

1. **Context Blindness:** The model saw "Slurry" but missed "Sterile." It translated the noun without considering the adjective modifying it.
2. **The "Dirty Data" Bias:** Because there is more text on the internet about "Cement Slurry" than "Medical Ice Slurry," the model defaults to the dirty definition.
3. **Safety Criticality:** In MedTech, a register error isn't just awkward—it's a safety violation.

Portfolio: Patent Translation AI Alignment Framework

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Last Updated: January 27, 2026