Multi-Level Context Map Generator

Usage Instructions for Handoff

Conceptual Framework: This visualization uses **elliptical coordinates** derived from polar coordinates (r, ϕ) at each stage to map concepts across abstraction levels. The circular coordinates are transformed into a flat oval shape to provide more horizontal space for text:

- **Radius** r: Abstraction level (center = high abstraction, outer rings = lower abstraction/specific implementations)
- **Angle** ϕ: Aspect or dimension of the central concept
- **Coordinate transformation**: $(r, \phi) \to (r\cos\phi \cdot s_x, r\sin\phi \cdot s_y)$ where $s_x = 1.4$ (horizontal stretch) and $s_y = 0.8$ (vertical compression) create a flat oval layout
- **Visual style**: Nodes have no borders or backgrounds for a clean, minimal appearance
- **Progression**: Each level zooms into a concept from the previous level, making it the new center

How to Extend:

1. **Add a new level**: Pick any medium-to-low radius concept from the current level
2. Make it the **new center** of the next level
3. Define 6–8 **aspects** (angular positions) related to this concept
4. For each aspect, place labels at different **radii** (abstraction levels):
    - Center ($r = 0$): Central concept
    - Medium radius ($r = 2.6$): Intermediate concepts
    - Outer radius ($r = 4$): Concrete implementations/specifics

Customization Guide:

- Modify `\drawContextLevel` parameters: center text, petal labels, outer labels
- Adjust `petalRadius` (default: 2.6), `outerRadius` (default: 5) for sizing
- Change `numPetals` (default: 8) for more/fewer aspects
- Adjust `ellipseStretchX` (default: 1.4) and `ellipseStretchY` (default: 0.8) to modify the oval shape
- Connect levels with curved arrows showing progression
- Note: All nodes are borderless and backgroundless by design

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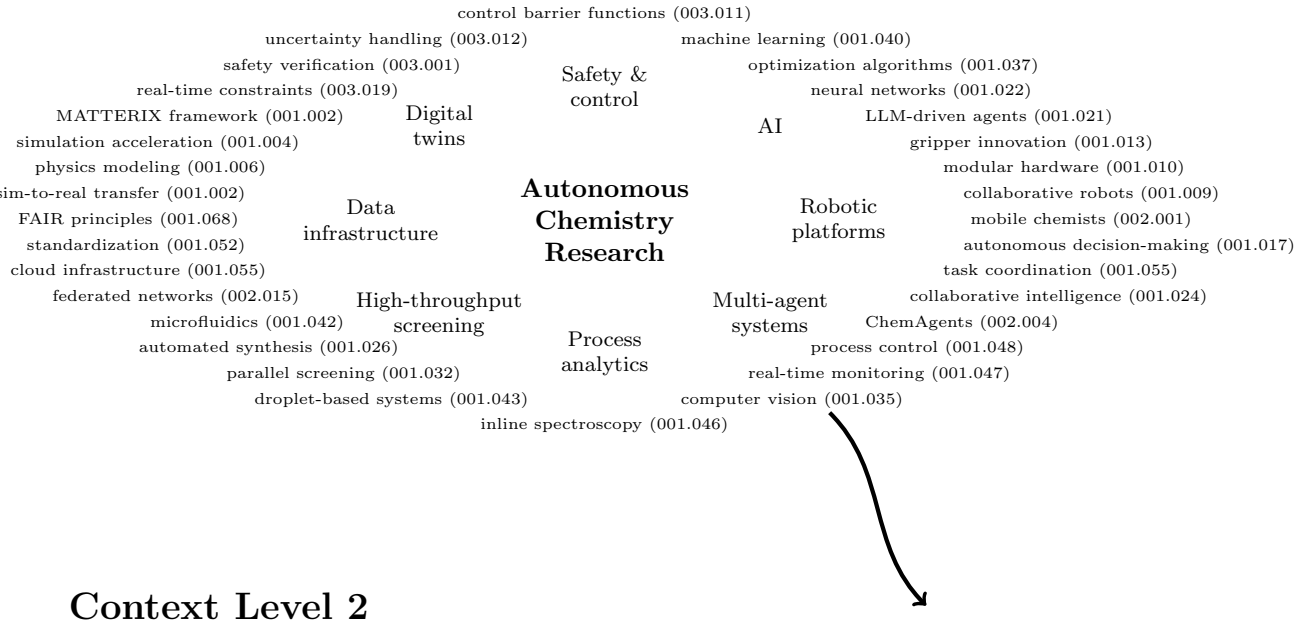
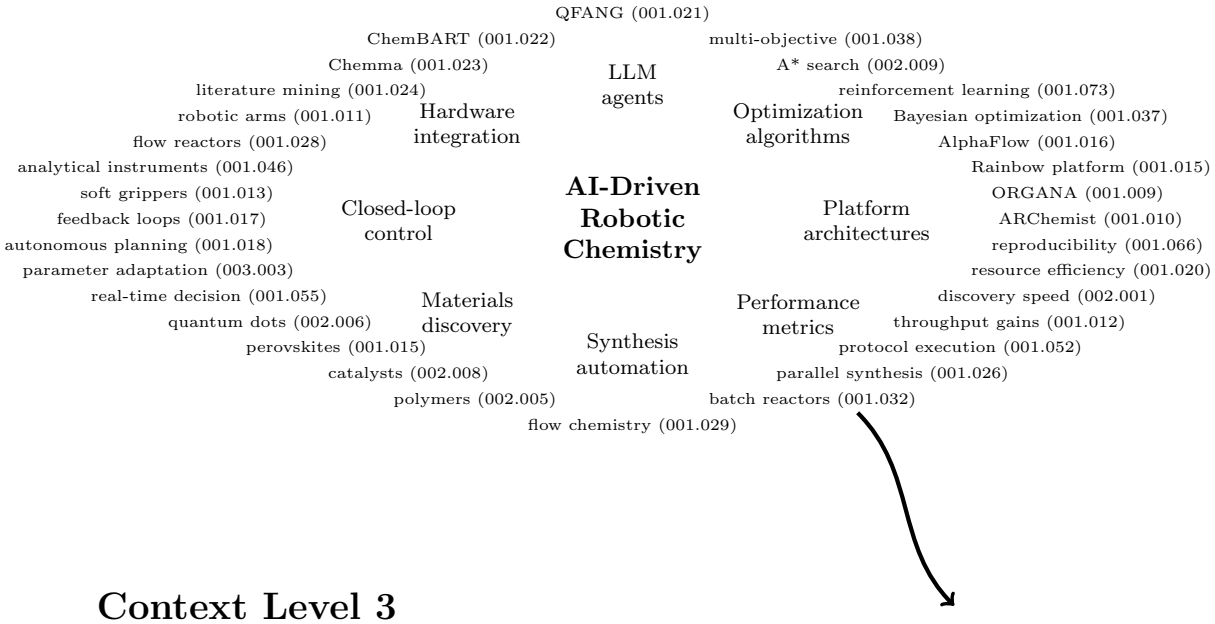
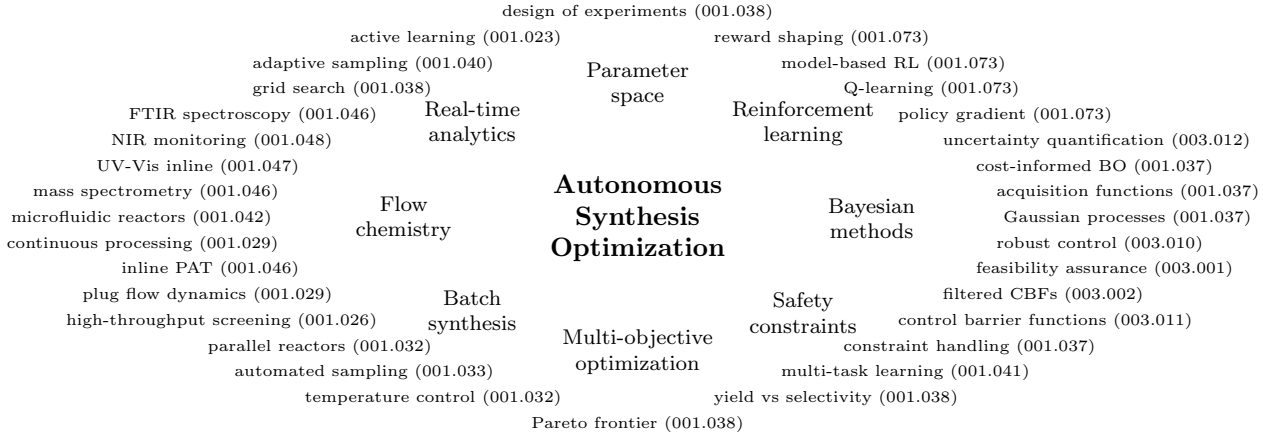
Context Level 1



Context Level 2



Context Level 3



Template for Adding Level 4

```
% Choose a concept from Level 3 (e.g., "Control Barrier Functions")
\drawContextLevel{x-position}{y-position}{Control Barrier\\Functions}{
    0/Uncertainty\\handling,
    1/High-order\\constraints,
    2/Filtered\\CBFs,
    3/Learning-based\\methods,
    4/Multi-agent\\coordination,
    5/Robustness\\guarantees,
    6/Computational\\efficiency,
    7/Feasibility\\assurance
}{
    0/adaptive DNNs (003.003),
    0.25/parameter estimation (003.003),
    0.5/worst-case bounds (003.010),
    0.75/stochastic systems (003.012),
    1/relative degree (003.004),
    1.25/truncated Taylor (003.004),
    1.5/rectified CBFs (003.005),
    1.75/reciprocal CBFs (003.006),
    2/input regularization (003.002),
    2.25/Lipschitz continuity (003.002),
    2.5/auxiliary dynamics (003.002),
    2.75/smoothness guarantees (003.002),
    ... (add more outer detail labels with (scope/item) tags)
}
```

Key Principle: Each level represents a **zoom-in operation**—taking a specific concept and exploring its constituent aspects and implementation details. The elliptical coordinate structure ensures both breadth (different aspects via angles) and depth (abstraction levels via radius) are captured simultaneously, with the flat oval layout optimized for text readability.

Context Map Content: This map visualizes the autonomous chemistry research landscape from perplexity documentation, progressing from high-level research ecosystem (Level 1) through AI-driven robotic platforms (Level 2) to detailed synthesis optimization techniques (Level 3). Each level contains 8 aspect categories with 32 specific implementations distributed across the outer radius.

Source Tagging: Each outer ring item includes a tag in the format `(scope/item)` that references the source document:

- **scope001**: "Full Research on Automation Efforts in Chemistry" (177 sources, 2020–2025)
- **scope002**: "Robotic Chemists: A Comprehensive Research Survey" (32 sources, curated selection)
- **scope003**: "Most Recent Reviews on Control Barrier Functions" (53 sources, latest advances)
- Each **itemXXX** corresponds to a specific source file within the respective scope folder
- **Source Directory**: `docs/perplexity/scope00X_*/`