LLM Council - Technical Report

Project: LLM Council - Local Deployment with Distributed Architecture for Cognitive Bias Analysis
Based On: Andrej Karpathy's LLM Council
Date: January 2026

Team Information

Institution: De Vinci Higher Education - Gen AI
TD Group: CDOF2
Submission Date: January 2026

Team Members:

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Key Design Decisions

1. Open source & Local execution

Decision : Use Ollama instead of OpenRouter

Implementation :

- Change OpenRouter for Ollama
- Update REST API calls based on Ollama API
- Change JSON payload content
- Create council.py and dedicated class to handle Ollama connection and running LLMs

Benefits :

- Runs locally using Ollama
- Doesn't require API keys
- Doesn't require any subscription
- Can run offline

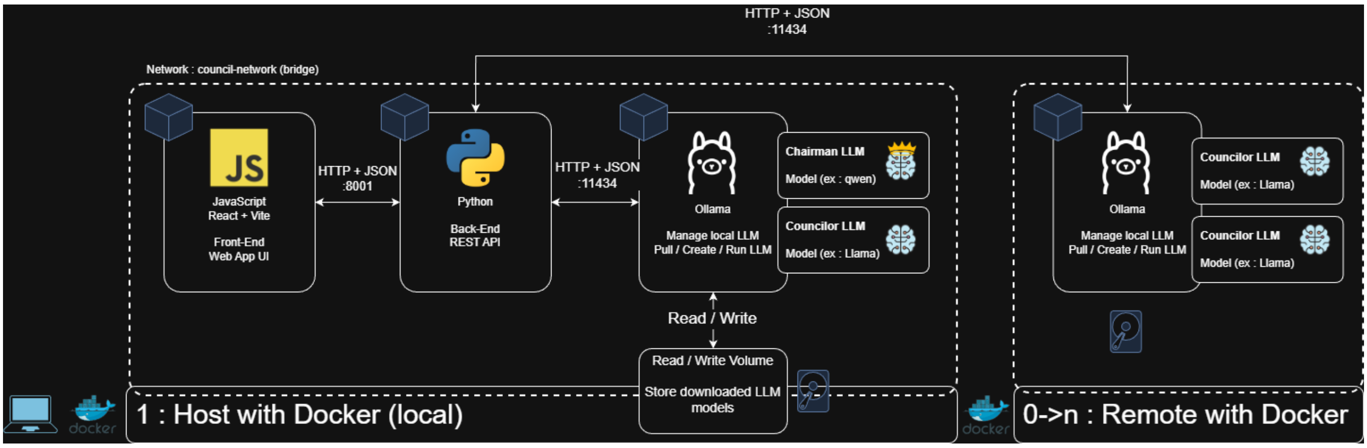
2. Distributed Execution

Decision : Distribute Ollama instances among machines on the same local network

Implementation :

- Created models.py to handle LLM config.
- Create enums to configure models roles and status.
- Added IP and port specification support.
- Updated config.py to handle new configuration requirements.
- Also added support to build new LLMs models based on system prompt.
- Exposed machine ports for Ollama / backend to allow REST calls
- Updated architecture, see below

Architecture :



- **Host Machine** (Control Node):
  - **Always runs**: Chairman model (required for Stage 3 synthesis)
  - **Always runs**: Backend API + Frontend UI (orchestration and user interface)
  - **Can optionally run**: 0+ councilor models
- **Remote Machine(s)** (Compute Nodes):
  - **Runs**: 0+ councilor models each
  - **Scalable**: Add as many Remote machines as needed
  - **Role**: Provides distributed computational capacity

Benefits :

- Allow the host to run the pipeline (standalone) : front + back + ollama with 1 chairman & 0+ councilors
- Allow remotes to run ollama : ollama with 0+ councilors
- The host can distribute LLMs request to remotes machines
- Distribute processing power between multiple computers.
- Can run in standalone & distributed modes

3. Containerisation

Decision : Use Docker to build, load and run the project

Implementation :

- Create dockerfiles for frontend, backend and ollama
- Create docker-compose file for host and for remote

- Created dedicated network and volumes for the containers
- Exposed containers ports for backend & ollama

Benefits :

- Runs ollama without requiring a full installation
- Runs easilly, simple configuration, update and build
- Scalability

4. Three-Stage Deliberation Process

Decision: Use a multi-stage process (Initial Response + Peer Review + Synthesis).

Implementation:

- Backend manages the query & reception of individual answers
- Anonymous peer-review
- Independant synthesis

Architecture:

```
┌────────────────────────────────────────────────────┐
│ STAGE 1: Initial Analysis (Parallel Execution)      │
│                                                    │
│       ┌─────────┐  ┌─────────┐  ┌─────────┐        │
│       │ Llama   │  │ Gemma   │  │  Phi3   │        │
│       │ 3.2:1b  │  │ 2:2b    │  │ 3:3.8b  │        │
│       └────┬────┘  └────┬────┘  └────┬────┘        │
│            │  Independent Responses  │             │
└────────────┼────────────┼────────────┼─────────────┘
             │            │            │
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                          │
                          ▼
┌────────────────────────────────────────────────────┐
│ STAGE 2: Peer Review (Cross-Evaluation)            │
│ Each model anonymously ranks others' responses     │
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                          │
                          ▼
┌────────────────────────────────────────────────────┐
│ STAGE 3: Final Synthesis (Chairman Model)          │
│        Consolidates all perspectives               │
└────────────────────────────────────────────────────┘
```

Benefits :

- Reducing individual model biases and groupthink.
- Synthesis consolidates the best insights from all councilor models
- User can monitor each stage

Chosen LLM Models

1. Selected Models

Role	Model	Parameters	RAM Usage	Location	Usage
Chairman	Qwen 2.5:1.5b	1.5B	~2GB	Always on Host	Fast synthesis, good at consolidating multiple inputs
Councilor 1	Llama 3.2:1b	1B	~1.5GB	Host or Remote	Meta's latest small model, strong reasoning for size
Councilor 2	Gemma 2:2b	2B	~3GB	Host or Remote	Google's model, different training approach than Llama
Councilor 3	Phi3:3.8b	3.8B	~5GB	Host or Remote	Microsoft's research model, deepest analysis of the three

Main considerations :

1. **Size**: Small enough to run on consumer hardware (1-4B parameters)
2. **Diversity**: Different architectures and training approaches to maximize perspective variety
3. **Performance**: Good reasoning capabilities for bias detection tasks
4. **Availability**: Free and open-source models available via Ollama

2. Models Description

Qwen 2.5:1.5b

- **Synthesis-Optimized**: Qwen models excel at summarization and consolidation tasks.
- **Multilingual**: Good performance in multiple languages (useful for non-English queries).
- **Small Size**: 1.5B parameters means fast inference for the final synthesis step.
- **Recent Training**: Qwen 2.5 has more recent training data compared to older Llama versions.

Llama 3.2:1b

- **Architecture**: Meta's transformer-based architecture
- **Strengths**: Good at identifying social and authority biases
- **Inference Speed**: ~2-3 seconds per query (CPU)
- **Can run on**: Host and/or Remote machines

Gemma 2:2b

- **Architecture**: Google's Gemini-inspired architecture (distilled)
- **Strengths**: Strong at logical fallacy detection, questioning assumptions
- **Inference Speed**: ~4-5 seconds per query (CPU)
- **Can run on**: Host and/or Remote machines

Phi3:3.8b

- **Architecture**: Microsoft Research dense transformer
- **Strengths**: Most comprehensive analysis, best at complex reasoning
- **Inference Speed**: ~8-10 seconds per query (CPU)
- **Can run on**: Host and/or Remote machines

3. Models Combination

The diversity in model size and architecture is intentional:

- **Llama 3.2** provides fast, concise analysis
- **Gemma 2** offers a different architectural perspective
- **Phi3** adds depth with its larger parameter count

This ensures the council doesn't suffer from "groupthink" - if all models were the same architecture (e.g., 3 Llama models), they might share similar biases.

Distribution Flexibility:

- **Recommended for demo**: All 3 councilors on Remote, chairman on Host
- **Alternative**: 1-2 councilors on Host, 1-2 on Remote
- **Advanced**: Councilors distributed across multiple Remote machines

4. Alternative Models Considered

Model	Non-selection explaination
Mistral 7B	Too large for Remote to run 3 instances simultaneously (would need 24GB+ RAM)
TinyLlama 1.1B	Lower quality responses, less suitable for bias detection
Llama 3:8B	Excellent quality but too slow for demo (15-20 seconds per query)
GPT-4 via API	Against project requirement of local-only execution

Improvements Over Original Repository

This project is based on the concept of LLM councils but has been significantly refactored and improved with the expected requirements.

1. Architecture

Monolithic to Distributed setup :

- **Original**: Monolithic single-machine setup
- **Our Improvement**:
  - Distributed multi-machine architecture
    - Host : 1 with chairman model + Backend + UI
    - Remote : 0+ with councilor models
- **Benefits**:
  - Better resource utilization across multiple machines
  - Demonstrates real-world distributed AI systems
  - Easier to scale horizontally by adding more Remote machines
  - Flexible: works with 1 machine (Host only) or N machines (Host + Remotes)

Cloud to local :

- **Original**: Cloud API-based (OpenRouter)

- **Our Improvement**:
    - Fully local with Ollama
    - Allowed connection to machines on local network
    - Refined configuration support
- **Benefits**:
    - No API costs
    - Complete data privacy (data never leaves local network)
    - Works offline after initial setup
    - Educational value in learning local LLM deployment and distributed systems

Sequential to Parallel execution :

- **Original**: Synchronous, sequential model querying
- **Our Improvement**:
    - Async/await parallel execution in Stage 1,
    - Queries distributed across Host and Remote machines concurrently
- **Benefits**:
    - Stage 1 now takes ~10 seconds instead of ~30 seconds (N models queried in parallel across machines)
    - Better server responsiveness
    - Modern Python best practices
    - Efficient network utilization

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2. Feature Additions Summary

Feature	Original	Our Implementation
Ollama support	Open Router	Allow user to pull any model from ollama and run it locally (host or remote)
Distributed Architecture	Single machine only	Host with 0+ remote with flexible model selection & distribution
Web UI	CLI only	Modern React interface with 3-pane view, reviewed from original

Feature	Original	Our Implementation
Peer Review Visualization	Not shown	Stage 2 tab shows all rankings and scores
Docker Deployment	Manual setup	One-command deployment per machine with docker-compose
Network Configuration	Local only	Configurable IPs for distributed deployment across machines
Flexible Model Distribution	None	Configure which models run on Host vs. Remote(s)

Conclusion

The LLM Council project successfully demonstrates:

- **Distributed AI Architecture**: Multi-machine deployment (Host + 0 to N Remote) with proper network configuration
- **Flexible Model Distribution**: Chairman always on Host, councilors distributed as needed
- **Local-First Approach**: Privacy-preserving, cost-free inference with Ollama on each machine
- **Multi-Agent Collaboration**: Three-stage deliberation process reduces bias through distributed consensus
- **Modern Tech Stack**: Docker, FastAPI, React, async Python with network communication
- **Research Platform**: Data collection for studying AI bias reduction in distributed systems
- **Practical Application**: Working tool for cognitive bias detection

Key Contributions

1. **Educational**: Students learn distributed AI, local LLM deployment, async programming, containerization, and network configuration
2. **Research**: Platform for studying multi-model bias reduction and consensus-based AI across distributed systems
3. **Practical**: Usable tool for analyzing text for cognitive biases and logical fallacies
4. **Scalable**: Architecture supports 1 to N machines with flexible model distribution

Architecture Benefits

- **Host-centric design**: Chairman and orchestration always on Host ensures reliable synthesis
- **Scalable Remotes**: Add 0 to N Remote machines based on available hardware
- **Flexible distribution**: Councilors can run on Host, Remote, or both
- **Educational value**: Demonstrates real-world distributed AI architecture

Future Improvements

- [ ] Secure REST API registration & communication
- [ ] GPU acceleration support on Remote machines
- [ ] Model health monitoring dashboard showing status of all machines
- [ ] Dynamic model registration via API (add/remove Remotes at runtime)

- [ ] Export conversations with machine attribution
- [ ] Weighted voting based on model confidence scores and machine performance

Written with the assistance of AI tools.