CSC4200 Assignment 8 Report

Distributed Model Delta Synchronization and Overlay Networking

Team Members: William Ward, Liam Owenby, Nick Atkins
Date: 11/23/25
Node Identifiers Used: Liam1, Will1, Nick1

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1. Team Contributions

Will Ward

Primary Responsibilities:

- I implemented the broadcast_delta function.
- I did a lot with the original UDP_overlay, but we moved to Shannigrahi's solution after we found out that the formats had been changed. See reference solution.
- Working with pi.

Specific Contributions:

- Implemented the fragmentation logic for model deltas into chunks
- Pulled code to pi and did original testing.
- Led debugging efforts for packet loss and chunk reassembly issues

Nicholas Atkins

Primary Responsibilities:

- I implemented the apply_incoming_deltas function
- Verification logic to ensure models merged correctly
- Documentation and report writing

Specific Contributions:

- Put together chunk reassembly logic
- Created SHA-256 system to verify reassembled deltas
- Wrote model parameter merging code with proper tensor addition

Liam Owenby

Primary Responsibilities:

- Testing coordination across multiple devices
- CRC correction
- Assisted with the handle_message implementation

Specific Contributions:

- Set up multi-node testing environment
- Assisted with the PeerNode bug fixes

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2. Testing Process and Results

2.1 Test Environment

- **Number of Nodes:** Liam1, Will1, Nick1
- **Network Configuration:** Same subnet in AIEB 256
- **Test Duration:** we just let it run for around 15 minutes.

2.2 Test Scenarios

Test 1: Basic Two-Node Synchronization

- **Setup:** Pi-1 and Pi-2 on same network
- **Action:** Trained Pi-1 with "my name? → will"
- **Expected Result:** Pi-2 receives and applies delta
- **Actual Result:** Model merged but still doesn't output correct response.

Test 1: Basic Inter-Group Synchronization

- **Setup:** PIs on the same subnetwork but different code.
- **Action:** Trained Pi-1 with "my name? → will"
- **Expected Result:** Pi-2 receives and applies delta
- **Actual Result:** Trained Pi-1 with "my name? → will"

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3. Challenges Encountered and Solutions

Challenge 1: Issues with new formatting and Connecting with different Groups.

Problem: There was a new format provided. **Solution Attempted:** We pasted Shannigrahi's solution. **Final Resolution:** We connected with other groups.

Challenge 2: CRC Error

Problem: A CRC error was encountered when attempting to test the Pi's model.

Solution: We modified the _make_packet to pass the version in broadcast_model_chunk and send_model_chunk.

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4. Reflection and Insights

4.1 Technical Insights

- **What We Learned:** We learned that small changes in packet format can ruin our day
- **Added Improvement:** We added retransmission of the model's packets.

4.2 Distributed Learning Observations

- **Model Convergence:** Models converged but didn't seem to learn
- **Answer Quality:** Answers remained gibberish
- **Network Effects:** Whole lotta packets dropped
