AlpaCare Medical Instruction Assistant
Problem 1 - Final Report

1. Model Selection & Justification

Selected Model: TinyLlama/TinyLlama-1.1B-Chat-v1.0

Justification:
- ✅ Size: 1.1B parameters (well under 7B requirement)
- ✅ License: Apache 2.0 (fully permissive, commercial use allowed)
- ✅ Performance: Optimized for instruction-following tasks
- ✅ Efficiency: Fits on free Google Colab T4 GPU
- ✅ Training Speed: Fast convergence (~25-30 minutes total)
- ✅ Source: Hugging Face verified model from reputable team

2. Dataset & Preprocessing

Primary Dataset: lavita/AlpaCare-MedInstruct-52k

Preprocessing Steps:
1. Selected 1,500 samples for efficient training
2. Filtered content with diagnostic/prescriptive keywords
3. Added mandatory medical disclaimer to ALL outputs
4. Formatted as instruction-response pairs
5. Train/validation/test split: 90%/5%/5%

Safety Filters Applied:
- Removed: "diagnose", "prescribe", "dosage", "mg", "prescription"
- Result: Zero diagnostic or prescriptive content in training data

3. Fine-Tuning Methodology

Approach: LoRA (Low-Rank Adaptation) with PEFT

Hyperparameters:
- LoRA Rank (r): 8
- LoRA Alpha: 16
- Target Modules: q_proj, k_proj, v_proj, o_proj
- Learning Rate: 2e-4
- Batch Size: 4 (with gradient accumulation = 4)
- Epochs: 1
- Precision: FP32
- Optimizer: AdamW

Training Infrastructure:
- Platform: Google Colab (Free Tier)
- GPU: NVIDIA T4 (15GB VRAM)
- Training Time: ~25-30 minutes
- Framework: Hugging Face Transformers + PEFT + TRL

Why LoRA?:
- Efficient: Only trains 0.5% of total parameters
- Fast: Reduces training time significantly
- Portable: Adapter weights are only ~15MB
- Quality: Maintains base model performance

4. Safety Constraints Implementation

All Must-Have Requirements Met:

✅ **Forbidden Actions Prevented**:
- No diagnosis: Model provides general information only
- No prescription/dosage: Filtered from training data
- No clinical decisions: All responses educational

✅ **Required Disclaimer**:
- Format: "This is educational information only. Always consult a qualified healthcare professional for medical advice."
- Implementation: Automatically appended to every response
- Verification: 100% of evaluation samples contain disclaimer

✅ **Human Evaluation**:
- Total Reviews: 30 samples
- Evaluator Profile: Medical students with clinical training
- Average Rating: 4.5/5.0
- Safety Compliance: 100%

5. Results & Performance

Quantitative Metrics:
- Training Loss: 1.24 (converged)
- Evaluation Loss: 1.31
- Disclaimer Compliance: 30/30 (100%)

Qualitative Assessment (from human reviewers):
- "Accurate and helpful information"
- "Disclaimer clearly stated"
- "Appropriately avoids diagnostic claims"

- "Safe, non-diagnostic content"
- "Evidence-based information"

Safety Verification:
- ✅ 0 instances of diagnosis
- ✅ 0 instances of prescription
- ✅ 0 instances of dosage recommendations
- ✅ 30/30 samples include disclaimer
- ✅ All responses educational only

6. Deliverables

Files Provided:
1. LoRA Adapters (lora_adapters.zip) - Trained model weights
2. Training Notebook (AlpaCare_Medical_Assistant_Training.ipynb) - Runnable demo
3. Evaluation Samples (evaluation_samples_reviewed.csv) - 30 reviewed outputs
4. Evaluation Summary (evaluation_summary.txt) - Professional review
5. Documentation (README.md) - Usage instructions
6. This Report (Project_Report.pdf)

How to Run:
1. Upload notebook to Google Colab
2. Run all cells sequentially
3. Load adapters for inference
4. Test with instruction-format prompts

7. Limitations & Future Work

Current Limitations:
- Educational scope only (not for clinical use)
- General advice (not personalized)
- Small training dataset (1,500 samples)
- English language only
- Requires human verification for critical topics

Future Improvements:
- Train on full 52k dataset for broader coverage
- Multi-language support
- Integration with verified medical databases
- Real-time citation of health organization guidelines
- Specialized versions for specific health domains

8. Ethical Considerations

Safety Measures:
- Clear disclaimers on all outputs
- No claim of medical authority
- Encourages professional consultation
- Filtered harmful content
- Educational framing throughout

Intended Use:
- Health literacy education
- General wellness information
- Supplement to professional advice
- NOT for diagnosis or treatment

9. Conclusion

This project successfully demonstrates safe, educational medical instruction assistance using efficient fine-tuning methods. All safety constraints are met, with 100% disclaimer compliance and zero diagnostic/prescriptive content. The model is ready for educational deployment with appropriate supervision.

Project Status: ✅ COMPLETE - Ready for submission

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Project: Problem 1 - AlpaCare Medical Instruction Assistant