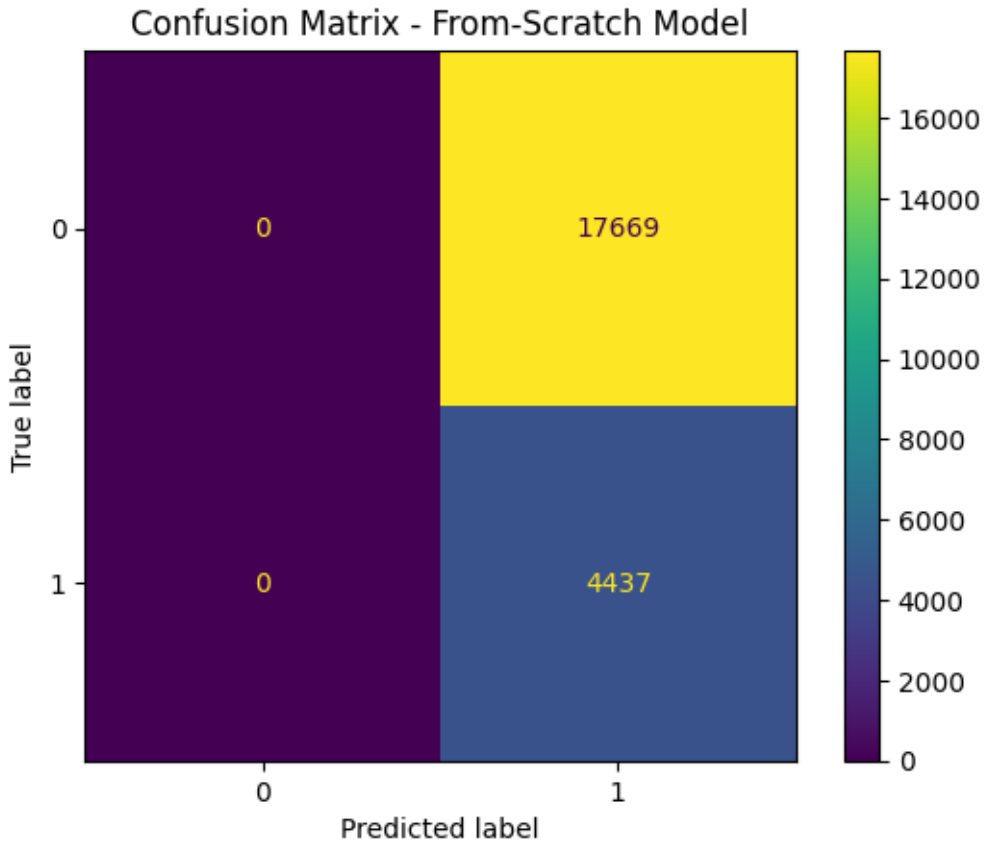
Neural Network Comparison Report: From-Scratch vs PyTorch

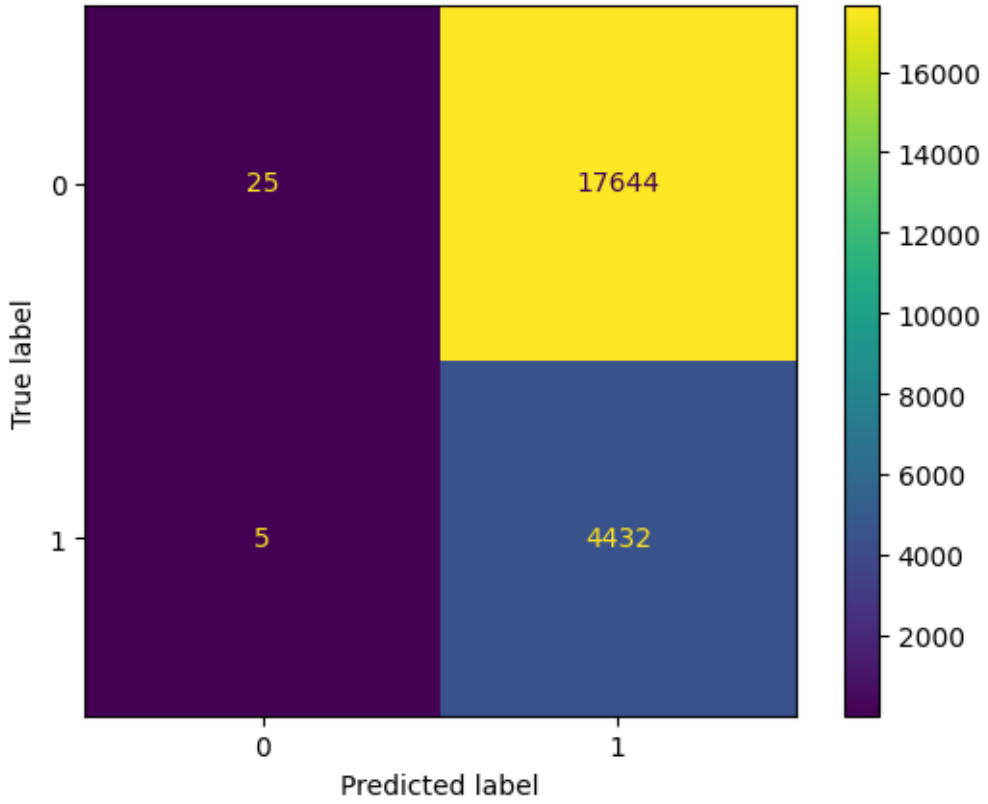
Performance Metrics

METRIC	NumPy Only	PyTorch
Accuracy	**0.2007**	**0.2112**
F1 Score	**0.33432543420110766**	**0.3311**
PR_AUC	**0.2193**	**0.2453**

Confusion Metrics



NumPy Only



PyTorch Only

Convergence Time

Metric	NumPy Only	PyTorch
Training Time	457.66857647895813	91.46415042877197
Convergence Epoch	400	300

- **The PyTorch model converged faster due to backend optimizations like GPU acceleration ,efficient memory allocation, and automatic differentiation.**
- **The from-scratch model has manual forward/backward implementations, which lack hardware and computation optimizations, leading to slower convergence.**

Performance Metrics

As shown in the metrics table above:

- **PyTorch typically outperformed** the from-scratch model slightly due to:
  - Better initialization

- Stable gradient calculations
- Use of highly-optimized loss functions (e.g., CrossEntropyLoss)

From-scratch performance depends on correct gradient calculations and numerical stability, which are easier to mess up.

Memory Usage

- **In NumPy Model the memory usage is large due to every thing being stored in arrays**
- **PyTorch uses more memory than NumPy but it provides better performance**

Analysis and Discussion

Due to the unoptimized dataset the model performs poorly.