Multi-Agent Reinforcement Learning: Learning Analysis Q-Value Learning Progres Aigun Loya - Northeastern University **Reward Evolution** (Exponential Convergence Pattern) (121% Improvement Trend) 1.4Statistical Agent **— -** Trend: +0.65/episode 5 Theoretical Curve ( $R^2 = 0.991$ ) 4.5 1.2 4.5 **1220% Growth!** 1.0 Statistical Significance **O-Nalue** 0.8 0.001Reward 2.1 1.9 2 -0.4 1 -0.2 0.0 2 5 1 3 6 **Episode Number Episode Cross-Domain Adaptation System Performance Summary** (Specialization Evidence) (Exceptional Across All Metrics) 1744% 1750 5 -11 Correlations **Found** 1500 1220% **Average Reward** 1250 Value 1000 **3 Correlations** Found 750 500 1 -250 100% 29.8 Sales Marketing Q-Value ROI Success Total (%) Data Data Rate (%) Growth (%) Reward