# From Separation to Participation: Predicting Reserve Service Outcomes using Machine Learning in the Australian Defence Force

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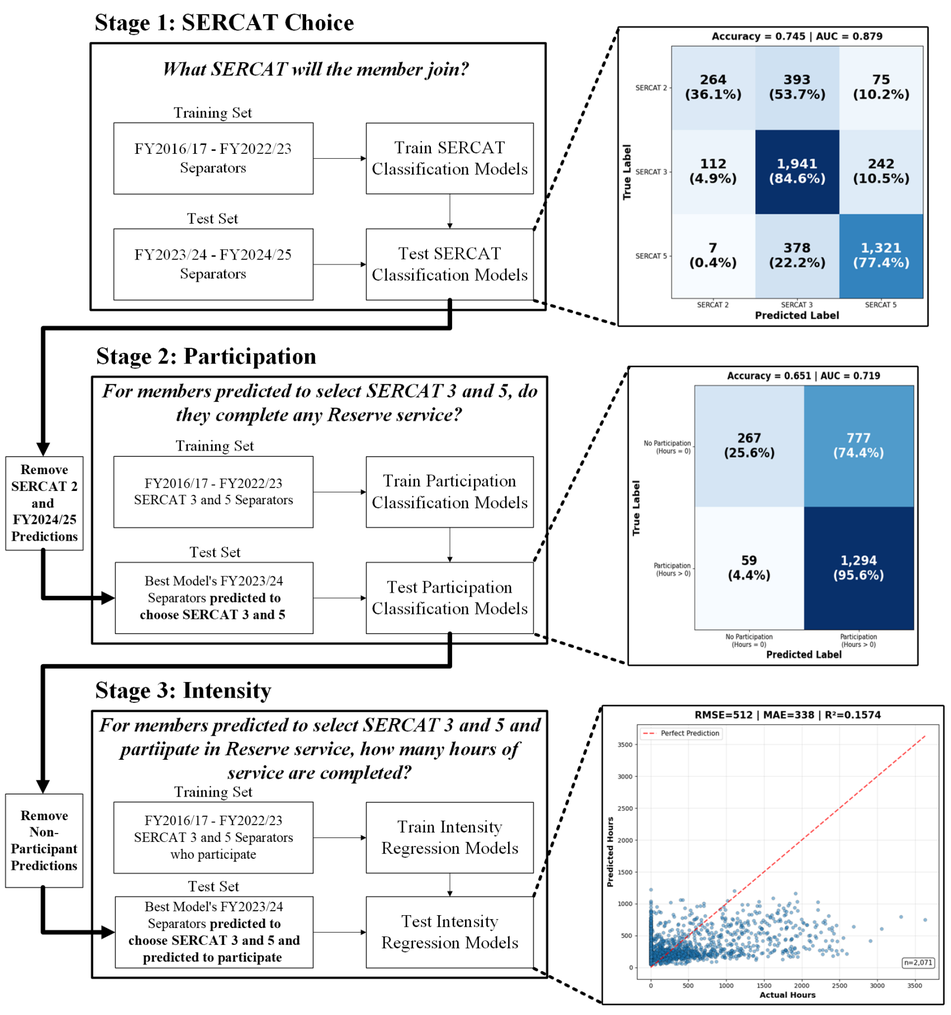
## Abstract

The Australian Government has directed the Australian Defence Force (ADF) to increase its Reserve workforce by 1,000 members by 2030; however, current recruitment and full-time-to-Reserve transition rates are insufficient to meet this target. This thesis uses individual-level demographic, geographic, and economic data to train and evaluate machine learning models that predict Service Category (SERCAT) choice, Reserve participation and service intensity among separating full-time ADF members (FY2016–17 to FY2024–25). The models perform strongly in classifying SERCAT choice but substantially weaker for downstream participation and intensity outcomes. Institutional and geographic characteristics are most influential at separation, whereas personal and life-stage characteristics are more strongly associated with realized post-separation engagement. These findings show how machine learning can inform targeted Reserve outreach while revealing structural and individual constraints that limit participation.


## Methods




- Individual-level dataset of separating full-time ADF members (FY2016/17 to FY2024/25)
- Integrated demographic, service, geographic, and economic features
- Three-stage supervised machine learning modeling framework:
  - Stage 1: SERCAT Choice classification
  - Stage 2: Participation classification
  - Stage 3: Intensity regression
- Financial year-based train/test split to approximate real-world implementation
- Model interpretation of feature importance using Shapley Additive Explanations

## Results & Impact

- Strong performance in predicting SERCAT choice
- Substantially weaker performance for participation and intensity outcomes
- Demonstrates ML can support targeted Reserve outreach strategies
- Feature importance shifts across stages:
  - Institutional and geographic factors drive SERCAT choice
  - Personal characteristics dominate realized participation

## Future Research

- Incorporate longitudinal post-separation civilian employment data
- Integrate qualitative insights to capture unobservable characteristics of ADF members
- Evaluate the potential effects of individualized outreach, targeted incentives, and geographic-based interventions
- Leverage predictive modeling findings to guide causal analysis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