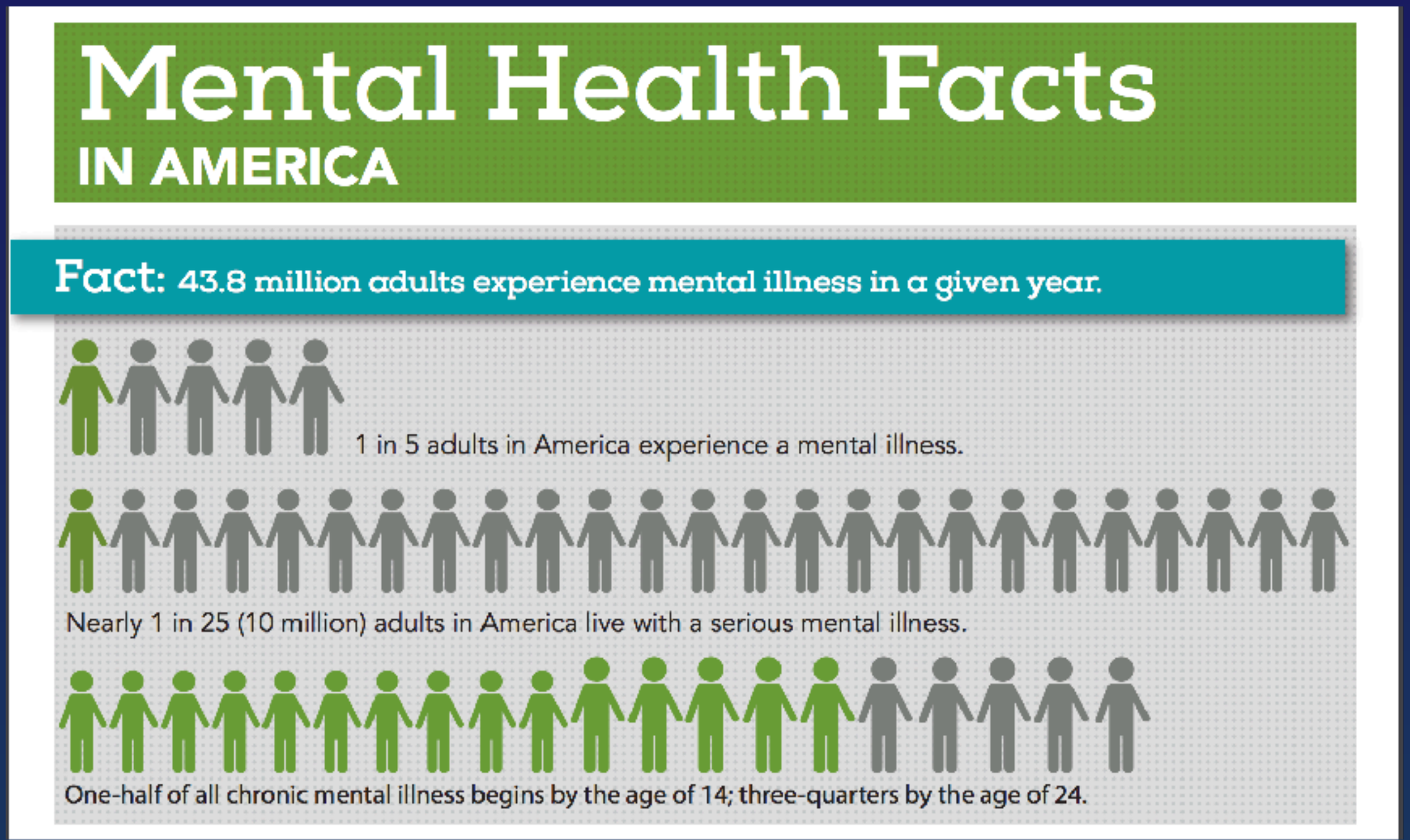
Predicting Who Will Seek Mental Health Treatment in the Tech Workplace

Kevin Hahn

May is Mental Health Month



https://www.nami.org/NAMI/media/NAMI-Media/Infographics/GeneralMHFacts.pdf

Context

- Prevalence
  - National Alliance on Mental Illness (NAMI) and National Institute of Mental Health (NIMH) reported that 60% of adults with mental illness received no treatment services in the past year
- In 2015, estimated 43.4 million (17.9% of U.S. adults) had a mental illness (NIMH, 2015)

Context

- Impact
  - CDC (2017): From 1981 to 2015, suicide is tenth leading cause of death for all adults
  - Insel (2008): In 2002 alone, Serious Mental Illness cost $317.6 billion in disability benefits, healthcare expenditures, and lost earnings

Context

- Impact on the workplace
  - Depression as most common and costly disorder

Dataset

- Open Sourcing Mental Illness (OSMI) 2014 Mental Health in Tech Survey
  - Believed to be largest survey on mental health in tech industry at that time
  - Measures “attitudes toward mental health and frequency of mental health disorders in the tech workplace”

Research Question

What factors predict whether tech employees will seek mental health services?

Variables

	Timestamp	Age	Gender	Country	State	Self-Employed	Family History	Work Interfere	Treatment
Data Type	Timestamp	Integer	String	String	String	Binary	Binary	Binary	Binary
Has NaNs?					Yes	Yes			
Cleaned?		Yes	No*					No*	
N	1259	1259	1259	1259	744	1241	1259	995	1259

Variables

	Number Employees	Remote Work	Tech Company	Benefits	Care Options	Wellness Program	Seek Help	Anonymity	Leave
Data Type	Categorical	Binary	Binary	Categorical	Categorical	Categorical	Categorical	Categorical	Categorical
N	1259	1259	1259	1259	1259	1259	1259	1259	1259

	MH Consequences	PH Consequences	Coworkers	Supervisor	MH Interview	PH Interview	Mental vs. Physical	Observed Consequences	Comments
Data Type	Categorical	Categorical	Categorical	Categorical	Categorical	Categorical	Categorical	Binary	String
Has NaNs?									Yes
N	1259	1259	1259	1259	1259	1259	1259	1259	164

Initial Model

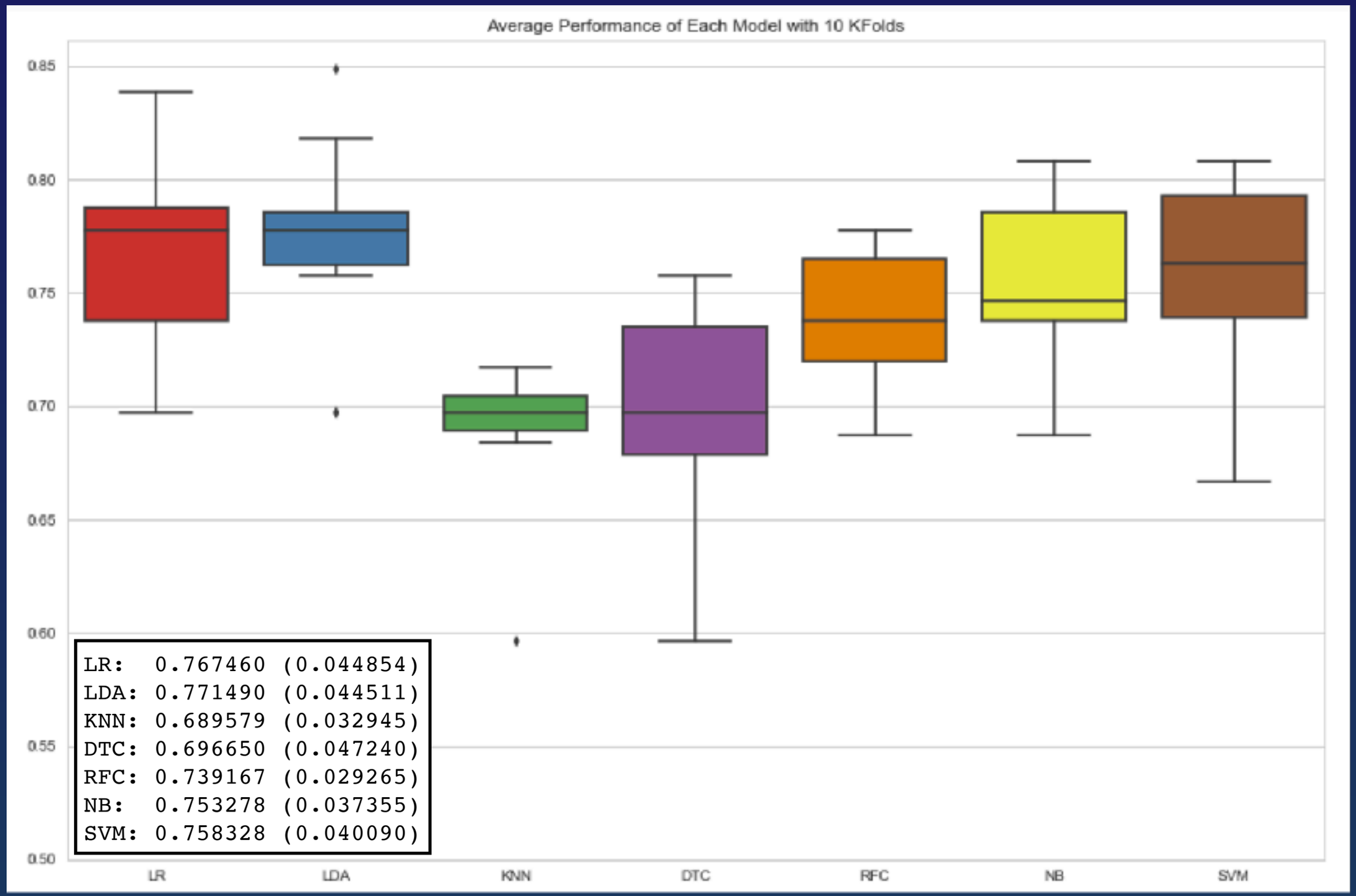
- *N* = 989
  - Dropped observations with ages below 18 and over 200
  - Dropped observations containing NaNs (work_interfere)
- Features = 22
  - Dropped features with highly imbalanced classes (Gender, Country, self_employed)
  - Dropped features with high frequency of missing data (US State, Comments)
  - Dropped Timestamp
  - Added 2 engineered features (US/non-US, Age < 40
- Outcome = Have you sought treatment for a mental health condition? (yes/no)

Initial Model

- *N* observations = 989, *p* predictors = 22
- Applied seven classifier methods:
  - Logistic Regression (LR)
  - Linear Discriminant Analysis (LDA)
  - K-Nearest Neighbor Classifier (KNN)
  - Decision Tree Classifier (DTC)
  - Random Forest Classifier (RFC)
  - Naive Bayes (NB)
  - Support Vector Machines Classifier (SVM)
- Used 10 k-folds cross-validation with mean accuracy (standard deviation accuracy)

```
LR:  0.767460 (0.044854)
LDA: 0.771490 (0.044511)
KNN: 0.689579 (0.032945)
DTC: 0.696650 (0.047240)
RFC: 0.739167 (0.029265)
NB:  0.753278 (0.037355)
SVM: 0.758328 (0.040090)
```

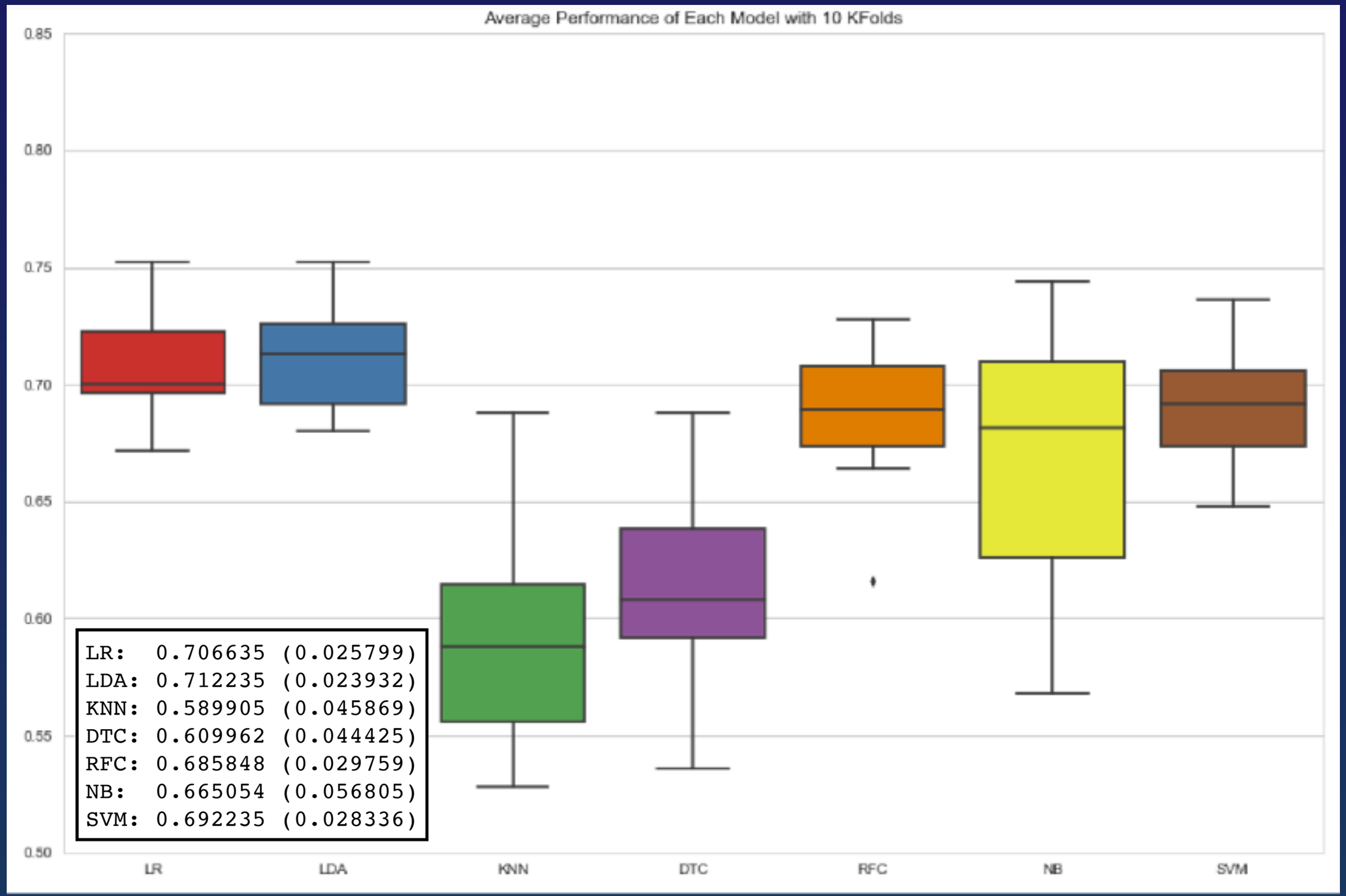
Initial Model



Revised Initial Model

- *N* = 1251
  - Removed work_interfere feature which increased *N*
- Features = 21
  - Dropped work_interfere feature (264 N/As):
    - If you have a mental health condition, do you feel that it interferes with your work? (Never, Rarely, Sometimes, Often)
    - Item is confusing and potentially misleading
    - Another way of stating outcome variable, or confirming participant mental illness?
- Outcome = Have you sought treatment for a mental health condition? (yes/no)

Revised Initial Model



FEATURE REDUCTION

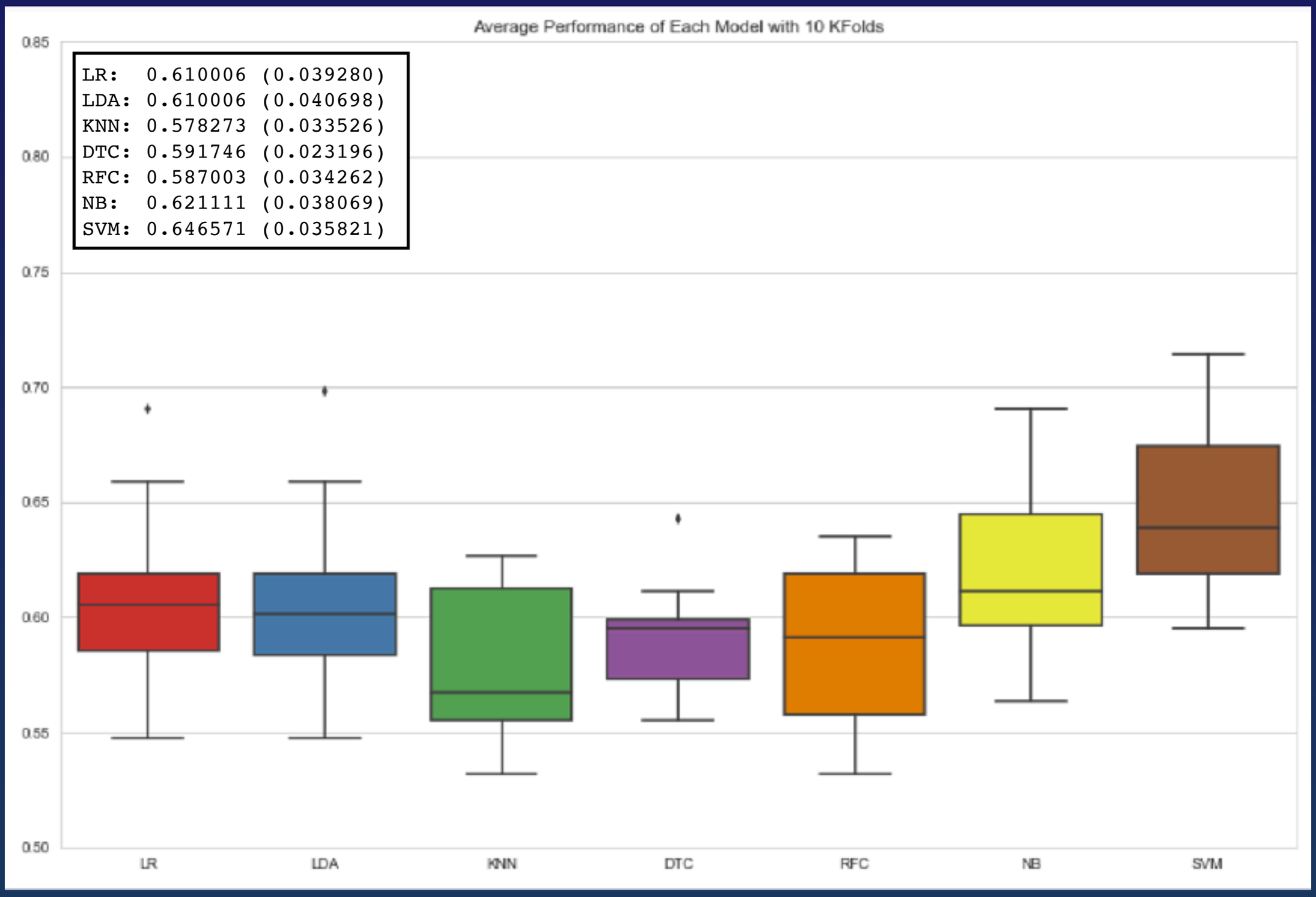
- *N* = 1251
  - Removed work_interfere feature to increase *N*
  - Dropped observations with ages below 18 and over 200
  - Dropped observations containing NaNs (self_employed)
- Features = 21
  - Dropped work_interfere feature because item is confusing and potentially misleading
  - Dropped Country variable due to highly imbalanced classes
  - Dropped features with very high frequency of missing data (US State, Comments)
  - Dropped Timestamp
  - Added 2 engineered features (US/non-US, Age < 40)

Tuned Model

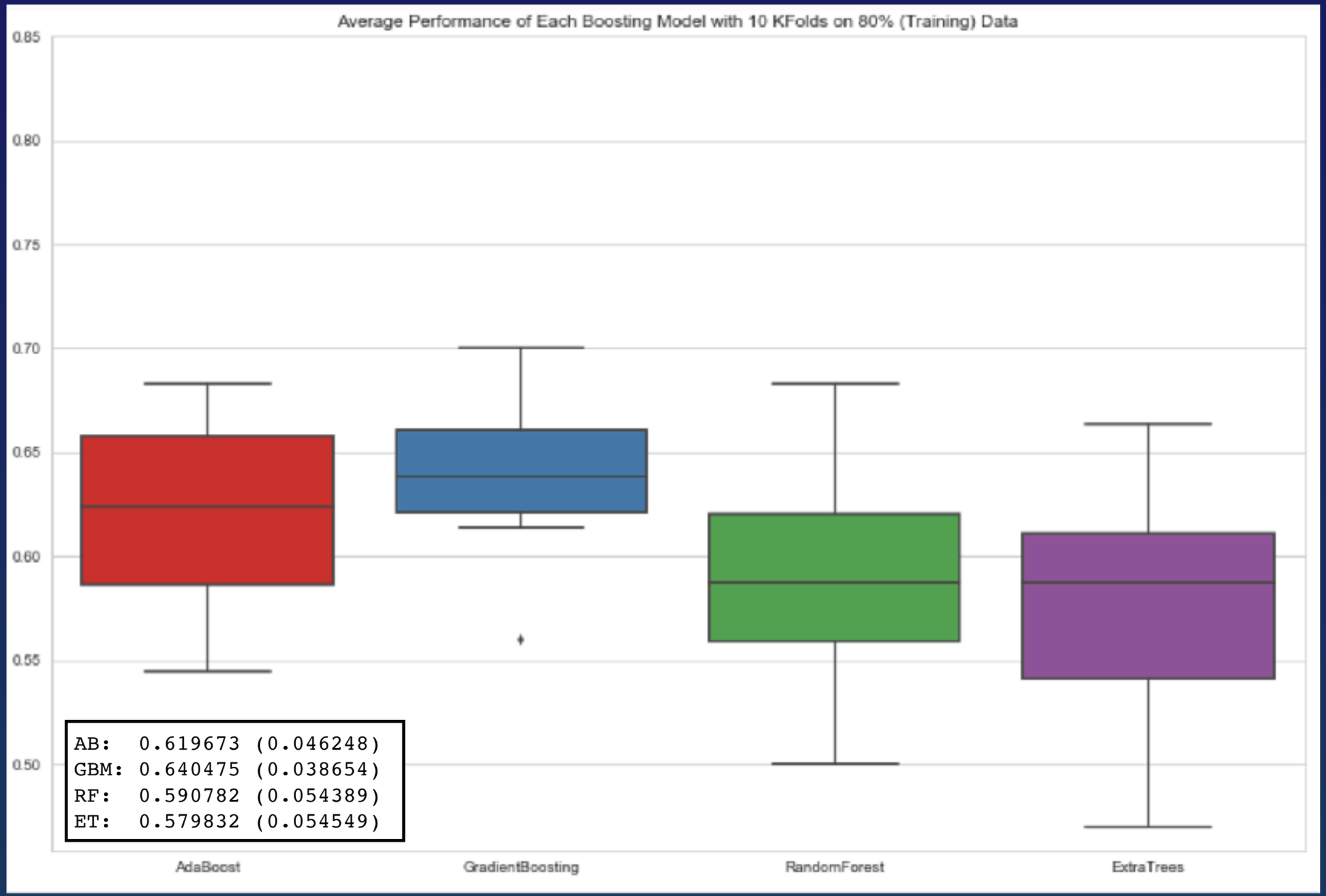
- *N* = 1259
  - Maximum N: Used only features that all participants answered
- Features = 6
  - (1) Number of employees, (2) ease of taking MH leave, (3) knowledge about available MH care options, (4) MH benefits, (5) availability of workplace wellness program, (6) employer-provided resources to seek help
  - Generally "actionable" features (e.g., employee education, workplace factors)
- Outcome = Have you sought treatment for a mental health condition?

Tuned Model

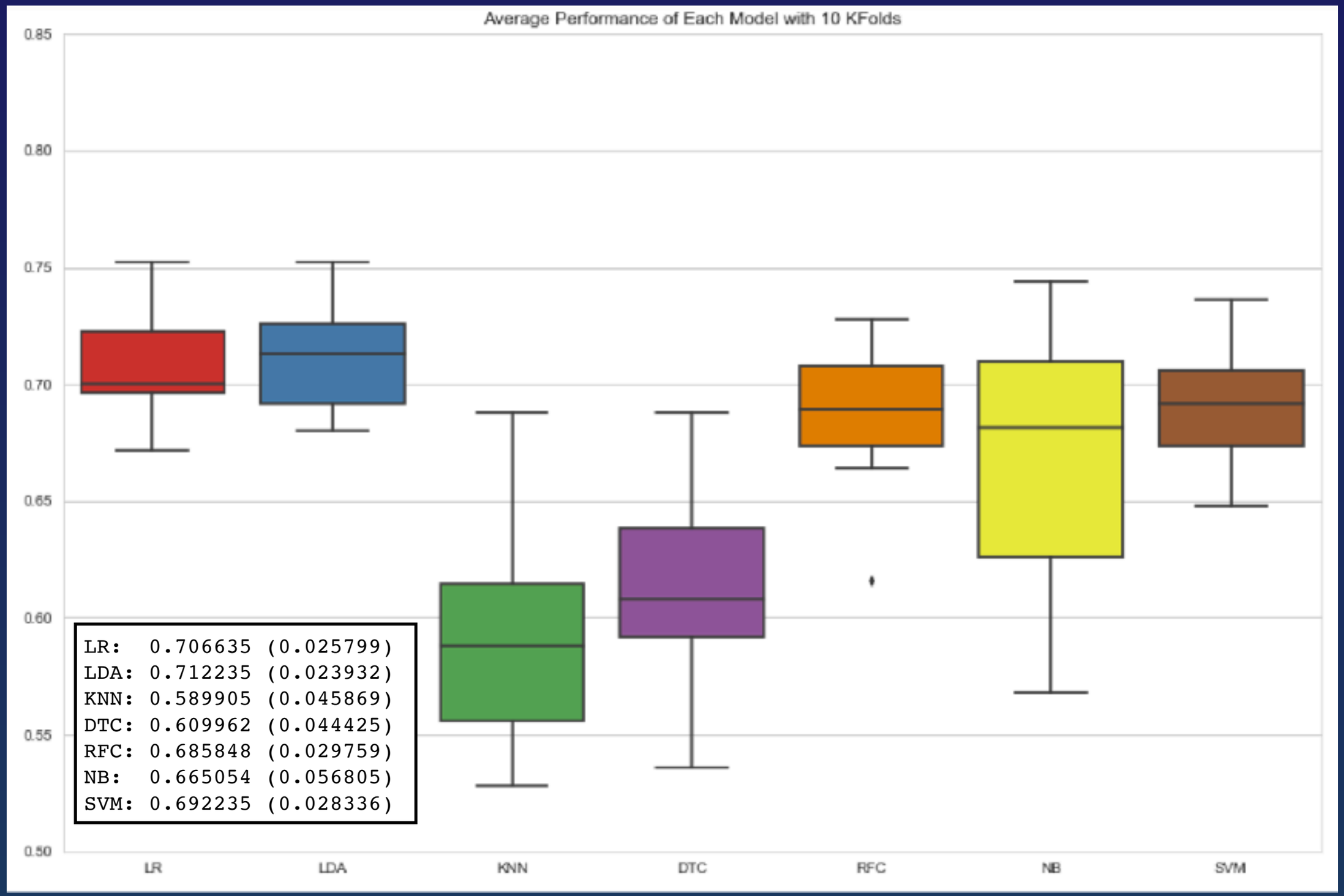
```
LR:  0.610006 (0.039280)
LDA: 0.610006 (0.040698)
KNN: 0.578273 (0.033526)
DTC: 0.591746 (0.023196)
RFC: 0.587003 (0.034262)
NB:  0.621111 (0.038069)
SVM: 0.646571 (0.035821)
```



Boosting Models



Hyperparameter Tuning



Outcome

- Take best/better models and compare just those (e.g., the LR, NB, SVMC)

Outcome

- The size of the organization, ease of taking leave, employees' knowledge about available mental health care options, availability of mental health benefits, availability of a workplace wellness program, and employee-provided resources about mental health resources may predict which tech employees will seek mental health services with approximately 65% accuracy.

Methodological Concerns

- Directionality/Causality
  - Does seeking mental health services predict workplace mental health benefits? Vice versa?
- Survey Items
  - Comments about needing N/A or I don't Know for certain items — e.g., family hx, MORE MORE MORE
- Words used interchangeably:
  - Condition
  - Diagnosis
  - Illness

Extensions

- Compare to OSMI's 2016 dataset (data collection still in progress!)
  - Validate model against similar outcome variable
    - Correlate responses using Likert-type scales
- Perform Text Analysis
  - Employ other text analyses (e.g., n-grams, NLP)
  - Determine how text supports or fails to support model

Conclusion

- Providing employee education about mental health care options and offering a workplace wellness program may predict tech employees' behaviors to seek mental health treatment
- Other factors such as the size of the organization and availability of mental health benefits may also predict which tech employees will seek mental health treatment
- These findings may or may not be representative for employees in other organizations

Questions?

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