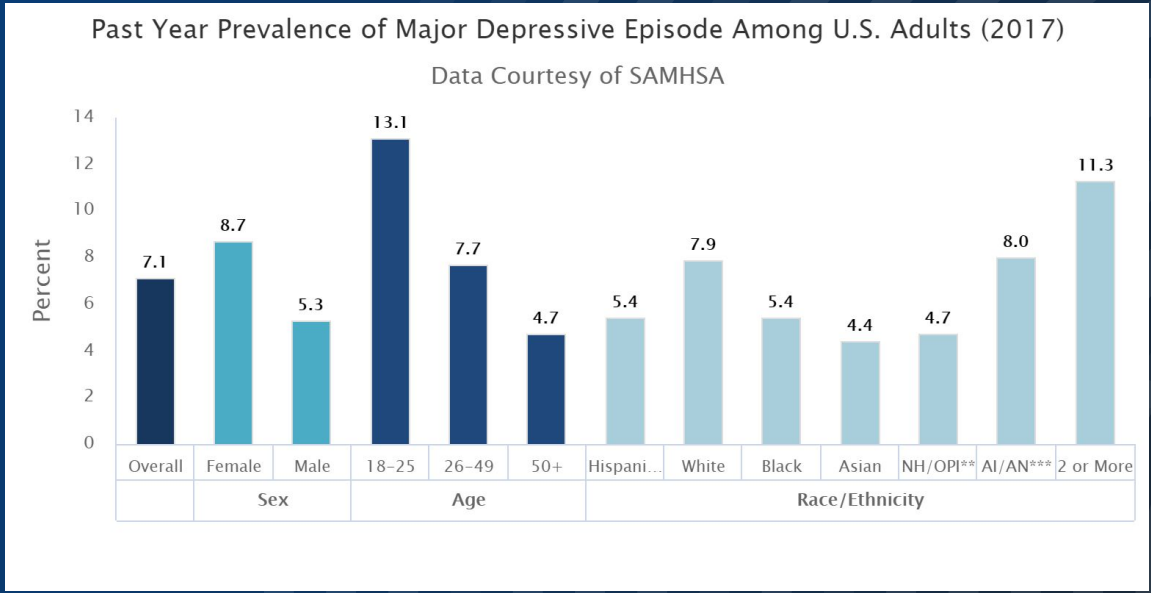
Predicting Depression Using Health Care Data

By Vivienne DiFrancesco

Depression

- 264 million people globally have depression - WHO
- 7.1% of US adults had a major depressive episode in 2017 with young adults being the most affected - NIMH



The Problem

- Physicians have become the front line for handling mental health disorders.
- The majority of physician visits are driven by mental disorders and few people follow up with a mental health professional.
- 90% of those who commit suicide have a mental health disorder and 40% had visited their doctor in the last month

Source: American Psychological Association

The Goal

- Study published in JAMA - Patients who receive more holistic care with doctors for mental health reduce healthcare costs and improve patient outcomes.
- This can be unfeasible for many reasons for lots of doctors
- Use machine learning to identify patients who have depression based on information that would be in a typical medical file anyway

Source: https://jamanetwork.chttps://jamanetwork.com/journals/jama/fullarticle/2545685om/journals/jama/fullarticle/2545685

Using machine learning to identify individuals with depression could connect patients with the help they need more quickly and easily while reducing healthcare costs and burden on physicians.

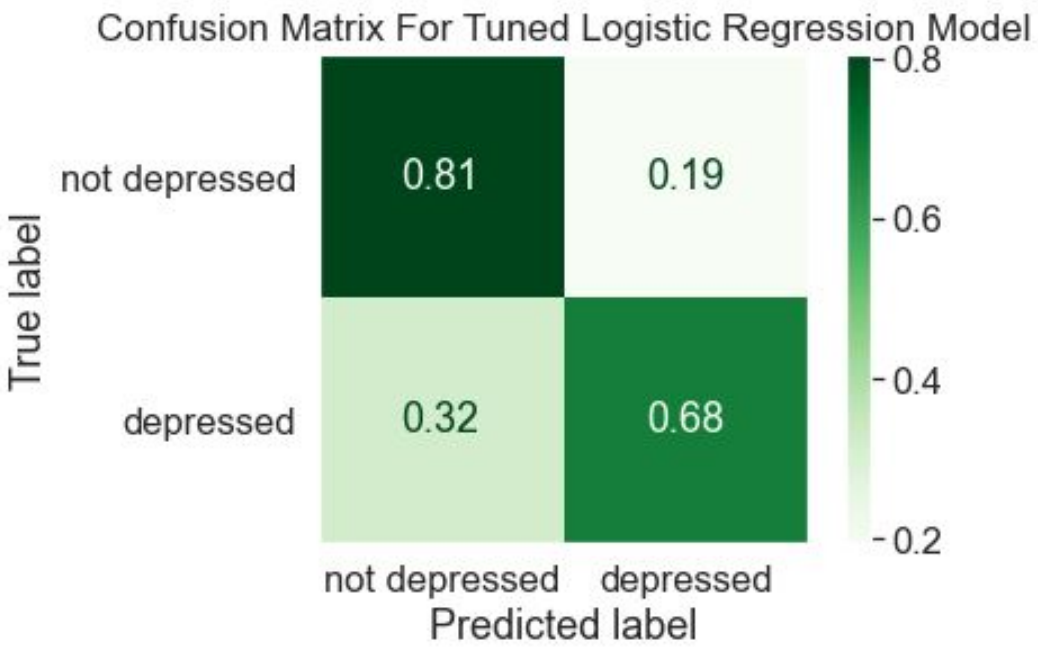
The Data

- CDC NHANES data
- 2005 to 2018 comprising 36259 entries total
- Tried to use data that was consistent across years and could reasonably be found in a patient's medical file
- Created labels of who was depressed and not depressed based on the "depression screener" in the data

Methods

- Classification of depressed or not depressed
- Roughly followed OSEMiN method
  - Obtain, scrub, explore, model, interpret
- Modeling was done from simple going to complex
- Wanted to use as few features as necessary
- Imbalanced data means accuracy was not a good metric
- Recall weighted more heavily to reduce false negatives

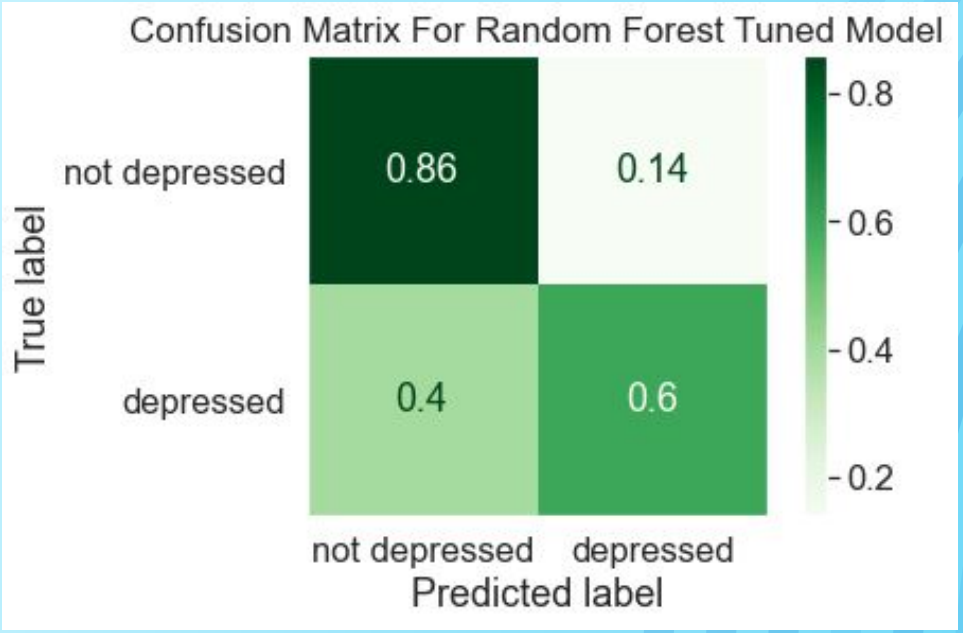
Best Model Results

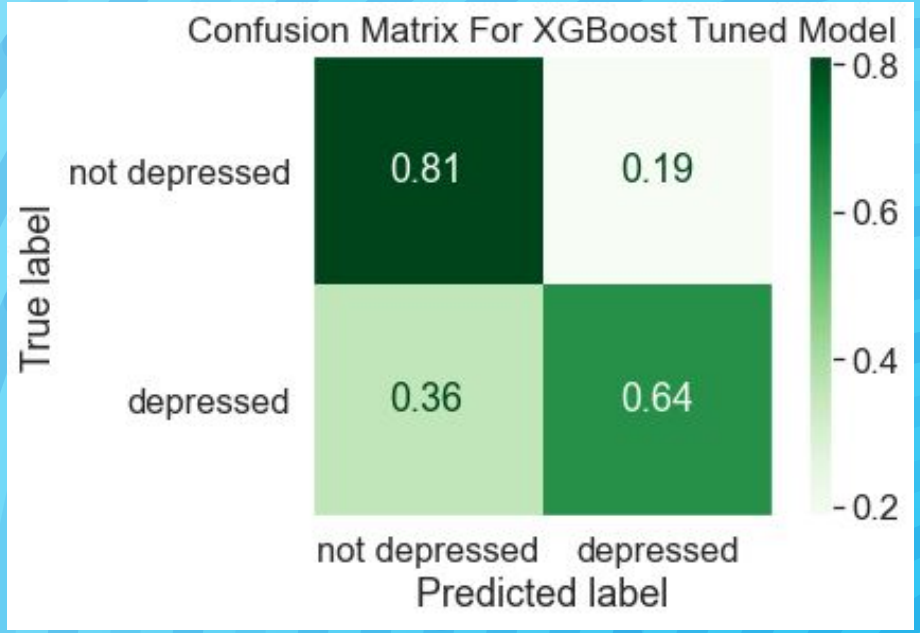


Logistic regression is a model that calculates probabilities of entries being in one or the other class then uses a 50% threshold to make the prediction.

Recommendation 1:

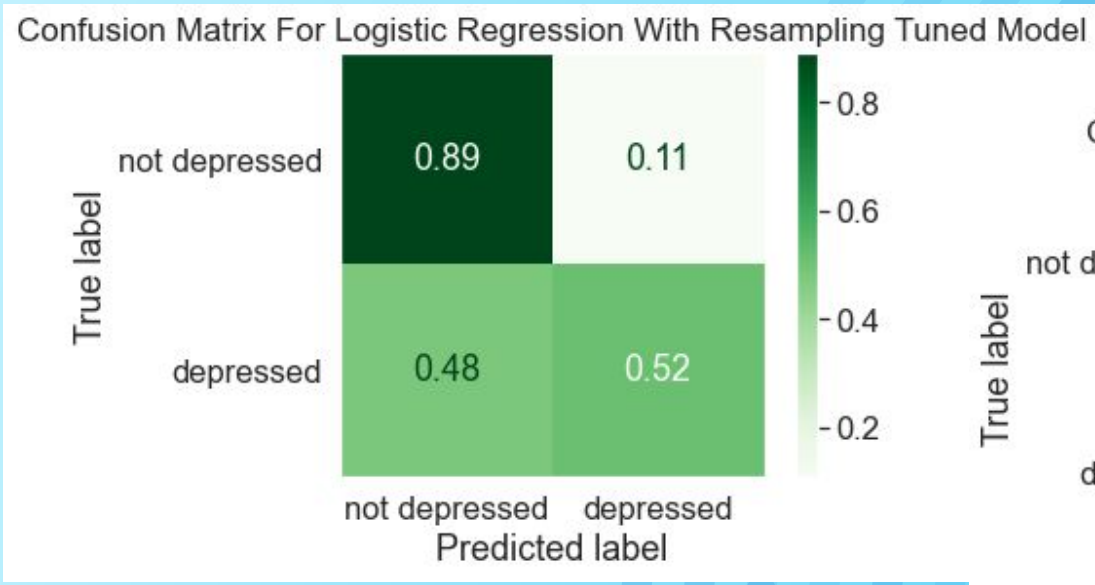
Don’t use tree based models

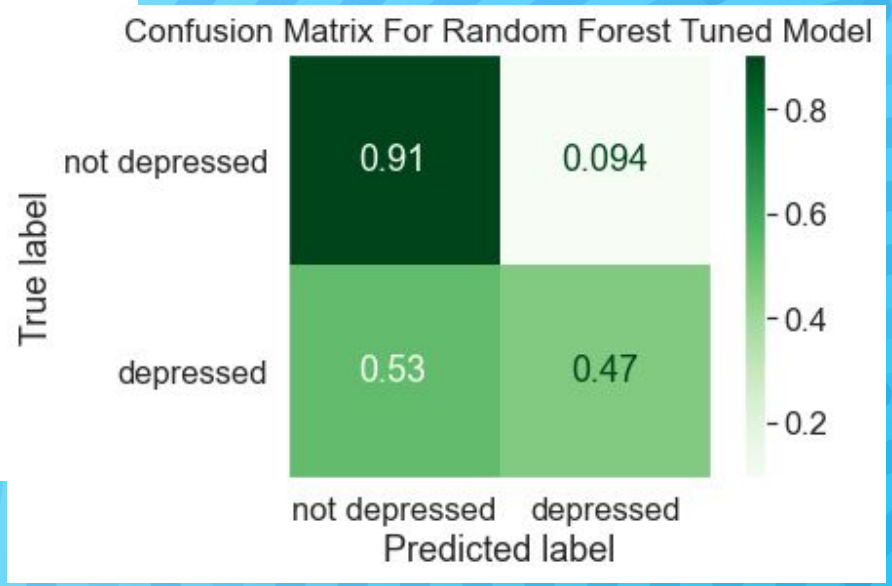




Recommendation 2:

Don’t use under sampling combined with SMOTE





Recommendation 3:

Everyone should prepare themselves to handle mental health problems including physicians

Symptoms:

- Aches and pains
- Bleak outlook on life
- Don’t care about things they used to love
- Sleeps/eats more or less than usual

Higher Risk:

- Young adults
- Females
- Those with serious health problems
- Out of work
- Decreased functionality
- Lower income

Recommendations Recap

1. Don’t use tree based models.
2. Don’t use under sampling combined with SMOTE
3. Everyone should prepare themselves to handle mental health problems including physicians

Future Work

- Try different models - perhaps neural networks
- Add more data
- Tuning and testing of parameters

Thank you for your time

Any questions?

Appendix

PHQ-9

Take the PHQ-9 online here: https://www.mdcalc.com/phq-9-patient-health-questionnaire-9

PATIENT HEALTH QUESTIONNAIRE-9

Over the last 2 weeks, how often have you been bothered by any of the following problems?	Not at all	Several days	More than half the days	Nearly every day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself — or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed? Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead or of hurting yourself in some way	0	1	2	3

FOR OFFICE CODING

_0_ + _____ + _____ + _____

=Total Score: _____

If you checked off any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?

Not difficult at all	Somewhat difficult	Very difficult	Extremely difficult
☐	☐	☐	☐