Machine Learning For Profit Based Investing
Predictive Modelling (2024 P3A)

Koen van Esterik   Steven Bontius

HAN - Master Applied Data Science

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Your Role in Today's Meeting

- Your Position: You are part of the Data Science leadership team of our investment company.
- The Challenge: Our telemarketing division is currently operating at a loss.
- The Proposal: We will present our research findings and a strategic plan for a turnaround.
- Your Objective: Evaluate our proposal and decide whether to approve this project.

Dear stakeholders - We are very excited to have you here today as we would like to present the findings of our research.

- Telemarketing division operating at a loss
- Increase the conversion rate of telemarketing calls
- Predictive modelling to select prospects
- Maximize profit from telemarketing calls

- Historical data
- Binary classification task
- Telemarketing prospect selection procedure

Introducing the **Maximum Profit** metric to evaluate the performance of predictive models as well as the profitability of the telemarketing division.

$$\vec{y_{pred}} = \sum_{i=1}^{\vec{thresholds}} \begin{cases} 1 & \text{if } \vec{y_{probs}} \geq threshold_i \\ 0 & \text{otherwise} \end{cases}$$

$$\vec{tps}, \vec{fns}, \vec{fps}, \vec{tns} = \sum_{i=1}^{\vec{thresholds}} \text{confusion\_matrix}(\vec{y_{true}}, \vec{y_{pred}})$$

$$total\ profit = \max\left(profit\ per\ subscription * \vec{tps} - cost\ per\ call * \vec{fps}\right)$$

Basically, we are calculating the profit for each threshold. Then we are plotting these results to create a **Profit Curve**. This plot allows us to find the **Maximum Profit**.

- Data Preprocessing
- Exploratory Data Analysis
- Splitting Data
- Cross Validating Models
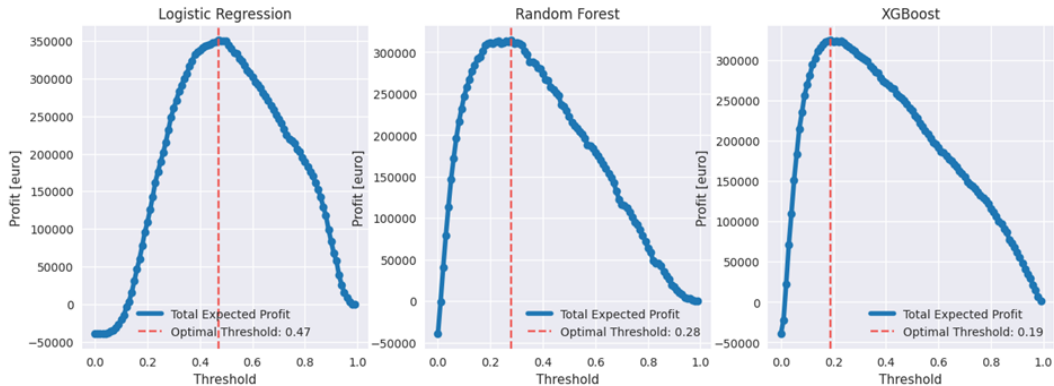- Selecting Model
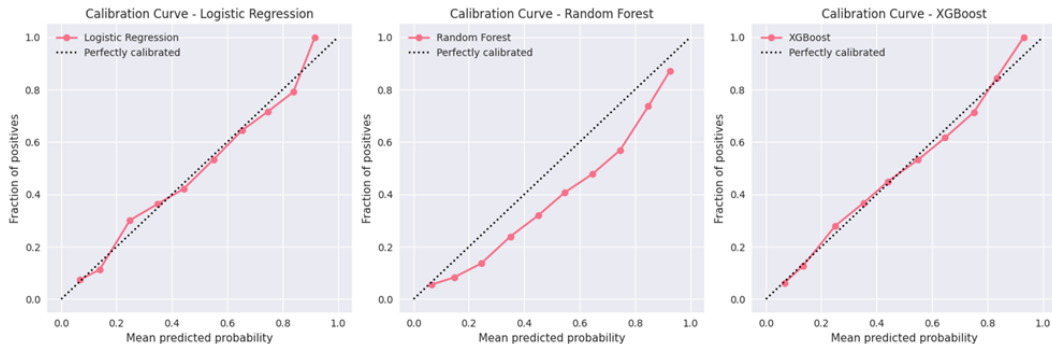- Evaluating Model
- Conclusion
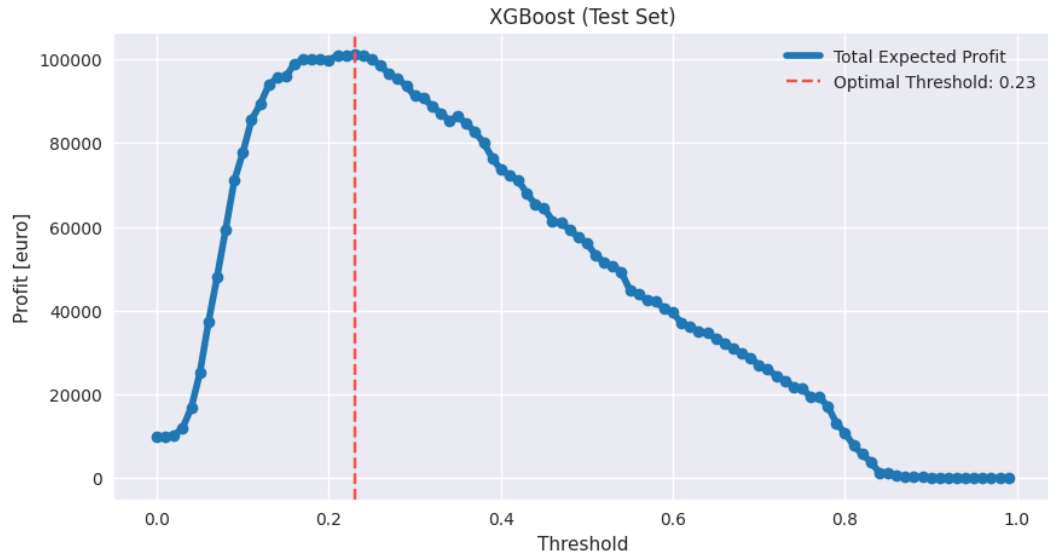
Figure 1: Model Shortlist
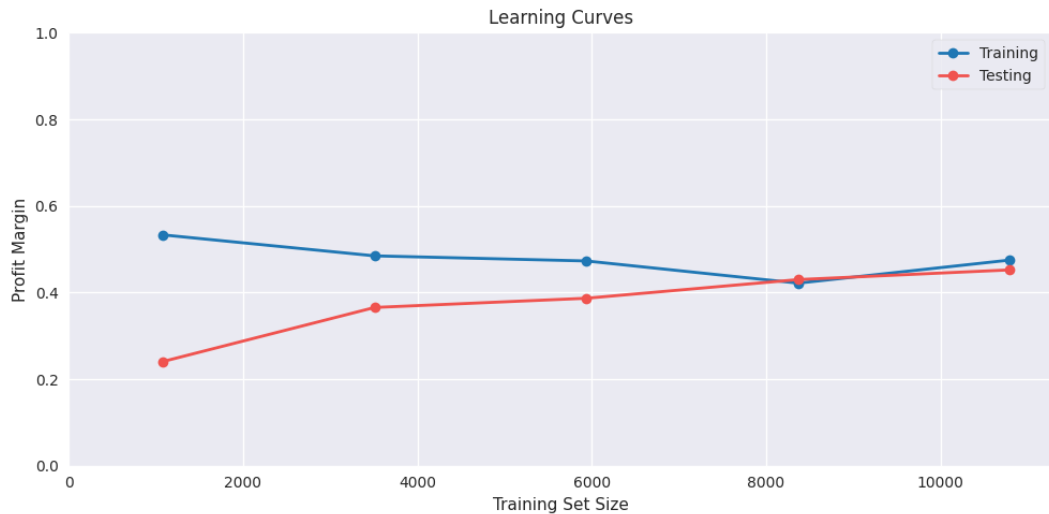
Figure 2: Model Calibration

Figure 3: Model Selection

Figure 4: Learning Curves

Comparison of Profit with and without Predictive Modelling:

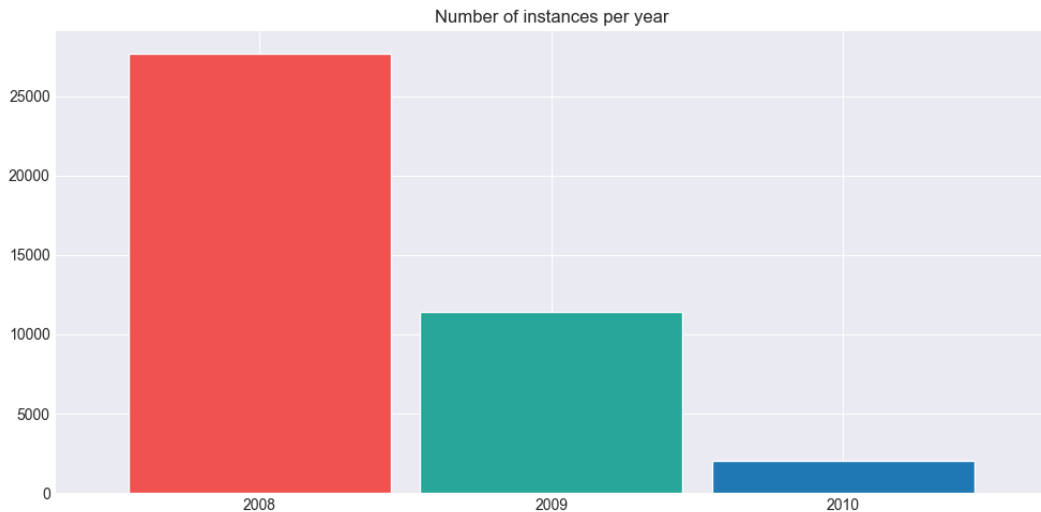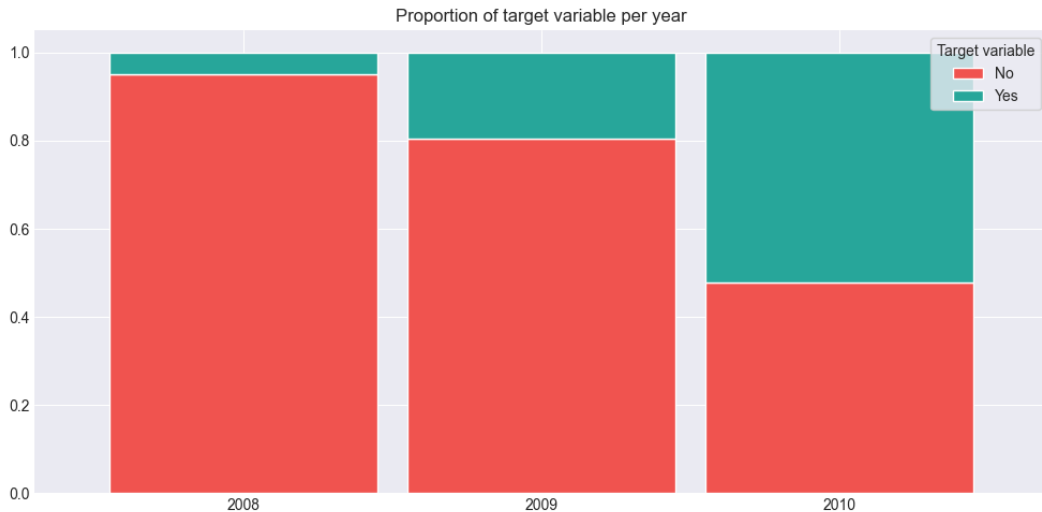| Procedure	Profit
Call All Prospects	10,000
Call Preselected Propspects	101,100

"Gas op die lolly?"

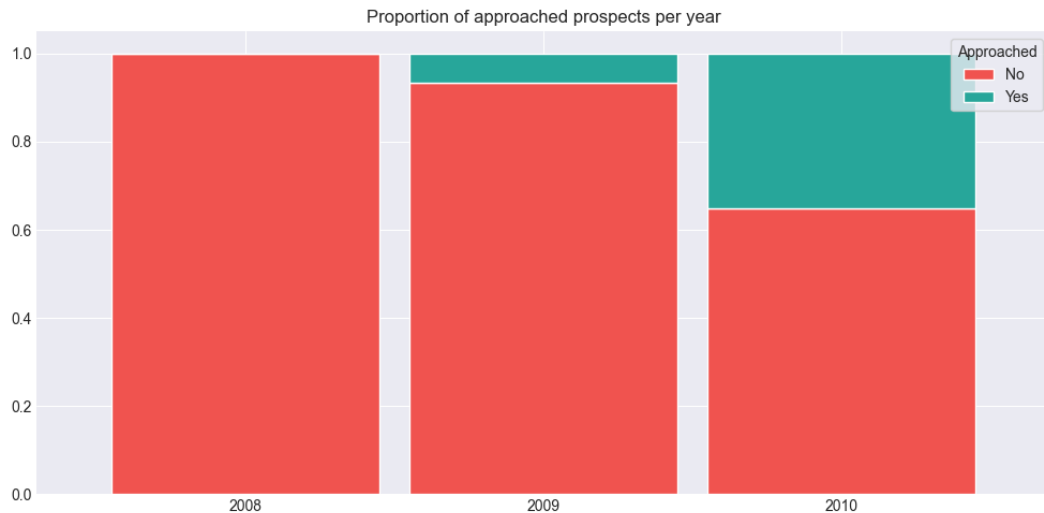Figure 5: Instances per Year

Figure 6: Proportion of Target Variable per Year

Figure 7: Proportion of Approached Prospects per Year

WHY DO WHALES JUMP
WHY ARE WITCHES GREEN
WHY ARE THERE MIRRORS ABOVE BEDS

WHY DO TESTICLES MOVE
WHY ARE THERE PSYCHICS
WHY ARE HATS SO EXPENSIVE
WHY IS THERE CAFFEINE IN MY SHAMPOO
WHY DO YOUR BOOBS HURT

WHY ARE THERE SLAVES IN THE BIBLE
WHY DO TWINS HAVE DIFFERENT FINGERPRINTS
WHY ARE AMERICANS AFRAID OF DRAGONS

WHY IS HTTPS CROSSED OUT IN RED
WHY IS THERE A LINE THROUGH HTTPS
WHY IS THERE A RED LINE THROUGH HTTPS ON FACEBOOK

WHY DO I SAY UH
WHY IS SEA SALT BETTER
WHY ARE THERE TREES IN THE MIDDLE OF FIELDS
WHY IS THERE NOT A POKEMON MMO
WHY IS THERE LAUGHING IN TV SHOWS
WHY ARE THERE DOORS ON THE FREEWAY
WHY ARE THERE SO MANY SWORDSTICKS RUNNING
WHY AREN'T THERE ANY COUNTRIES IN ANTARCTICA
WHY ARE THERE SCARY SOUNDS IN MINECRAFT
WHY IS THERE KICKING IN MY STOMACH
WHY ARE THERE TWO SLASHES AFTER HTTP
WHY ARE THERE CELEBRITIES
WHY DO SNAKES EXIST
WHY DO OYSTERS HAVE PEARLS
WHY ARE DUCKS CALLED DUCKS
WHY DO THEY CALL IT THE CLAP
WHY ARE KYLE AND CARTMAN FRIENDS
WHY IS THERE AN ARROW ON AANG'S HEAD
WHY ARE TEXT MESSAGES BLUE
WHY ARE THERE MUSTACHES ON CLOTHES
WHY ARE THERE MUSTACHES ON CARS
WHY ARE THERE MUSTACHES EVERYWHERE
WHY ARE THERE SO MANY BIRDS IN OHIO
WHY IS THERE SO MUCH RAIN IN OHIO
WHY IS OHIO WEATHER SO WEIRD
WHY ARE THERE MALE AND FEMALE BIKES

WHY AREN'T THERE DINOSAUR GHOSTS
WHY DO IGUANAS DIE

QUESTIONS
FOUND IN GOOGLE AUTOCOMPLETE

WHY ARE THERE SWARMS OF GNATS
WHY IS THERE PHLEGM

WHY AREN'T ECONOMISTS RICH
WHY DO AMERICANS CALL IT SOCCER
WHY ARE MY EARS RINGING
WHY ARE THERE SO MANY AVENGERS
WHY ARE THE AVENGERS FIGHTING THE X MEN
WHY IS WOLVERINE NOT IN THE AVENGERS

WHY IS THERE A WAR

WHY ARE THERE SO MANY CROWS IN ROCHESTER, MN
WHY IS PSYCHIC WEAK TO BUG
WHY DO CHILDREN GET CANCER
WHY IS POSEIDON ANGRY WITH ODYSSEUS
WHY IS THERE ICE IN SPACE

WHY ARE THERE ANTS IN MY LAPTOP

WHY IS THERE LIFE SO BORING

WHY IS EARTH TILTED
WHY IS SPACE BLACK
WHY IS OUTER SPACE SO COLD
WHY ARE THERE PYRAMIDS ON THE MOON
WHY IS NASA SHUTTING DOWN

WHY ARE THERE GHOSTS

WHY IS THERE AN OWL IN MY BACKYARD
WHY IS THERE AN OWL OUTSIDE MY WINDOW
WHY IS THERE AN OWL ON THE DOLLAR BILL
WHY DO OWLS ATTACK PEOPLE
WHY ARE AK47S SO EXPENSIVE
WHY ARE THERE HELICOPTERS CIRCLING MY HOUSE
WHY ARE MY BOOBS ITCHY
WHY ARE THERE GODS
WHY ARE THERE TWO SPOCKS

WHY ARE CIGARETTES LEGAL
WHY ARE THERE DUCKS IN MY POOL
WHY IS JESUS WHITE
WHY IS THERE LIQUID IN MY EAR
WHY DO Q TIPS FEEL GOOD
WHY DO GOOD PEOPLE DIE

WHY ARE THERE FEMALE MR MIMES

WHY ARE THERE MERMAIDS
WHY DO DYING PEOPLE REACH UP
WHY AREN'T WARLOCKS FRIENDLY
WHY ARE OLD KLINGONS DIFFERENT

WHY ARE THERE TINY SPIDERS IN MY HOUSE
WHY DO SPIDERS COME INSIDE
WHY ARE THERE HUGE SPIDERS IN MY HOUSE
WHY ARE THERE LOTS OF SPIDERS IN MY HOUSE
WHY ARE THERE SPIDERS IN MY ROOM
WHY ARE THERE SO MANY SPIDERS IN MY ROOM

WHY THE HELL

WHY ARE THERE SQUIRRELS

WHY DO SPIDER BITES ITCH
WHY IS DYING SO SCARY
WHY IS THERE NO GPS IN LAPTOPS
WHY DO KNEES CLICK

WHY IS SEX SO IMPORTANT

WHY IS MT VESUVIUS THERE
WHY DO THEY SAY T MINUS
WHY ARE THERE OBELISKS
WHY ARE WRESTLERS ALWAYS WET
WHY ARE OCEANS BECOMING MORE ACIDIC

WHY IS ARWEN DYING
WHY AREN'T MY QUAIL LAYING EGGS
WHY AREN'T MY QUAIL EGGS HATCHING
WHY IS STEALING WRONG
WHY AREN'T THERE ANY FOREIGN MILITARY BASES IN AMERICA

WHY IS PROGRAMMING SO HARD
WHY IS THERE A 0 OHM RESISTOR
WHY DO AMERICANS HATE SOCCER
WHY DO RHYMES SOUND GOOD
WHY DO TREES DIE
WHY IS THERE NO ROUND NUMBER 2 GRADES
WHY IS THERE NO POKEMON REAL
WHY AREN'T BULLETS SHARP
WHY DO DREAMS SEEM SO REAL

WHY IS ISOLATION BAD
WHY DO BOYS LIKE ME
WHY DON'T BOYS LIKE ME
WHY IS THERE ALWAYS A JAVA UPDATE
WHY ARE THERE RED DOTS ON MY THIGHS
WHY IS LYING GOOD

WHY ARE ULTRASOUNDS IMPORTANT
WHY ARE ULTRASOUND MACHINES EXPENSIVE

WHY AREN'T THERE GUNS IN HARRY POTTER

WHY ARE DOGS AFRAID OF FIREWORKS
WHY IS THERE NO KING IN ENGLAND

WHY IS HTTPS IMPORTANT
WHY ARE THERE WEEDS
WHY DO I FEEL DIZZY

WHY ARE THERE ZIPPERS ON ALL ZIPPERS

WHY AREN'T MY ARMS GROWING