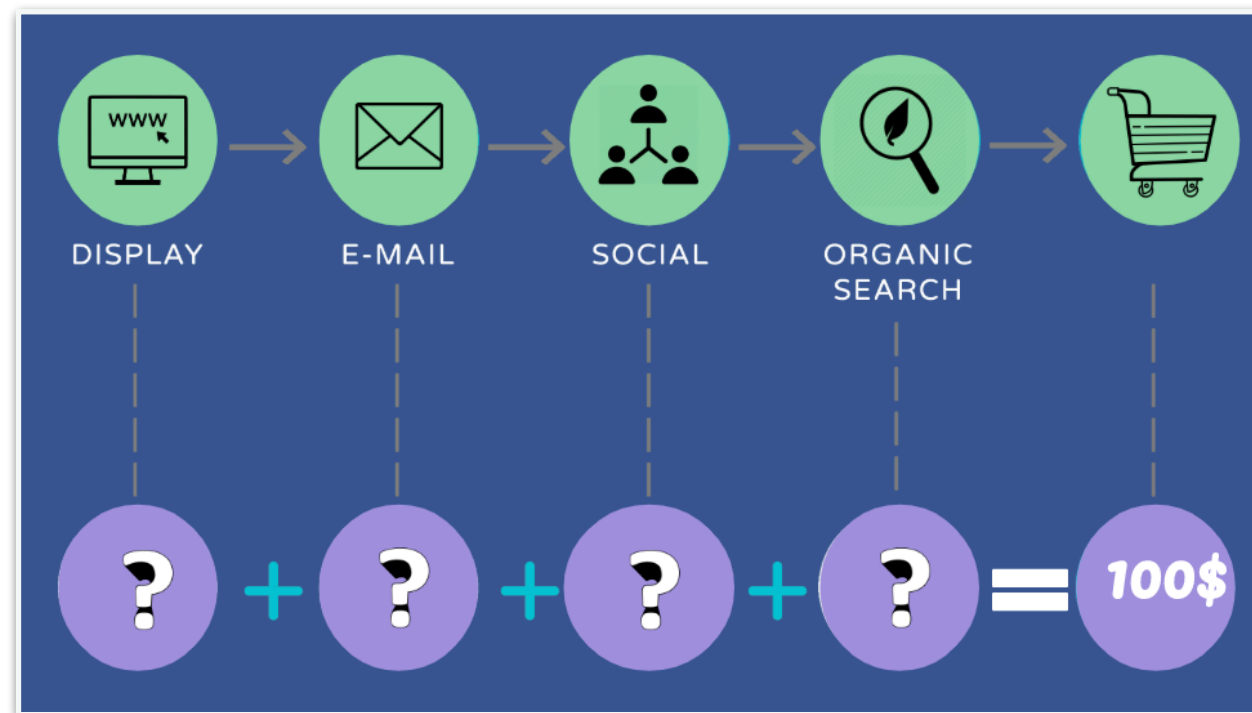# Probability theory
&
Marketing Attribution Model

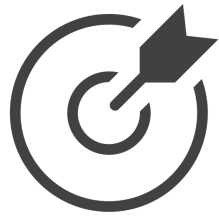The marketing-attribution problem

Game theory and Shapley value

The Marketing-Attribution Problem

The problem: Assign the credit of a purchase (a conversion) to the correct marketing channel(s).

Assumption: We know which channels the customer interacted with prior to their purchase.

Optimising spending on best channels

- ROI
- Understanding customer journeys
- Strategic investment

Last Touch

Position Based

Data Driven

Linear

Time decay

RULE BASED

ALGORITHM

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Chapter one

GAME THEORY & SHAPLEY VALUE

DEFINITION

FORMULA

APPLICATION

Part 1: Marketing Attribution Problem

- Game theory: A branch of applied mathematics that provides tools for analysing situations in which parties, called players, make decisions that are interdependent.

- Game theory aims to understand situations where rational decision-makers interact (e.g., take actions, threaten each other and possibly form coalitions)
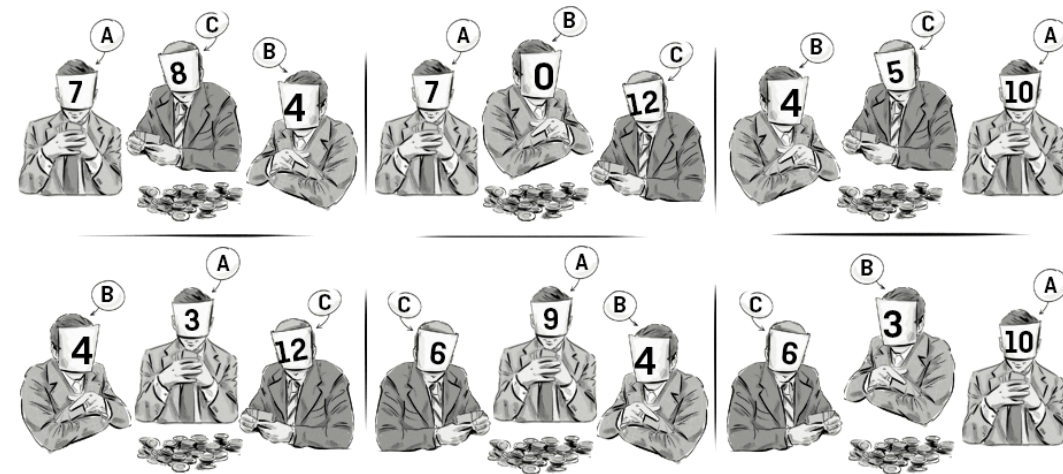
fx

- 1st: identify each player's contribution when they play individually, when 2 play together and when 3 play together …

fx

- 2nd: calculate average weighted contribution (marginal contribution) of each channel

$$\phi_i(v) = \sum_{S \subseteq N \setminus \{i\}} \frac{|S|!\,(n-|S|-1)!}{n!}(v(S \cup \{i\}) - v(S))$$

(7+7+10+3+9+10) / 6 =

7.7

Part 1: Marketing Attribution Problem

Customer journey = cooperative game
Each channel = one player
Together driving conversions

Part 2: Data challenge

Attribution in real life

- Last touch point model - one data point in customer journeys
- Internal datasets:
    1. App info (app_installs)
    2. Own tracking (user_campaign_data)
    3. (merchant_created)

- Solution: Shapley value model - all data points in customer journeys
    + GA data
    +…

GA challenges

1. Cookies dependency
2. Unable to track minimal sign-up via app
3. Unable to track across devices & browsers
4. One visitor_id: many organization_uuid
5. One organization_uuid: many visitor_id
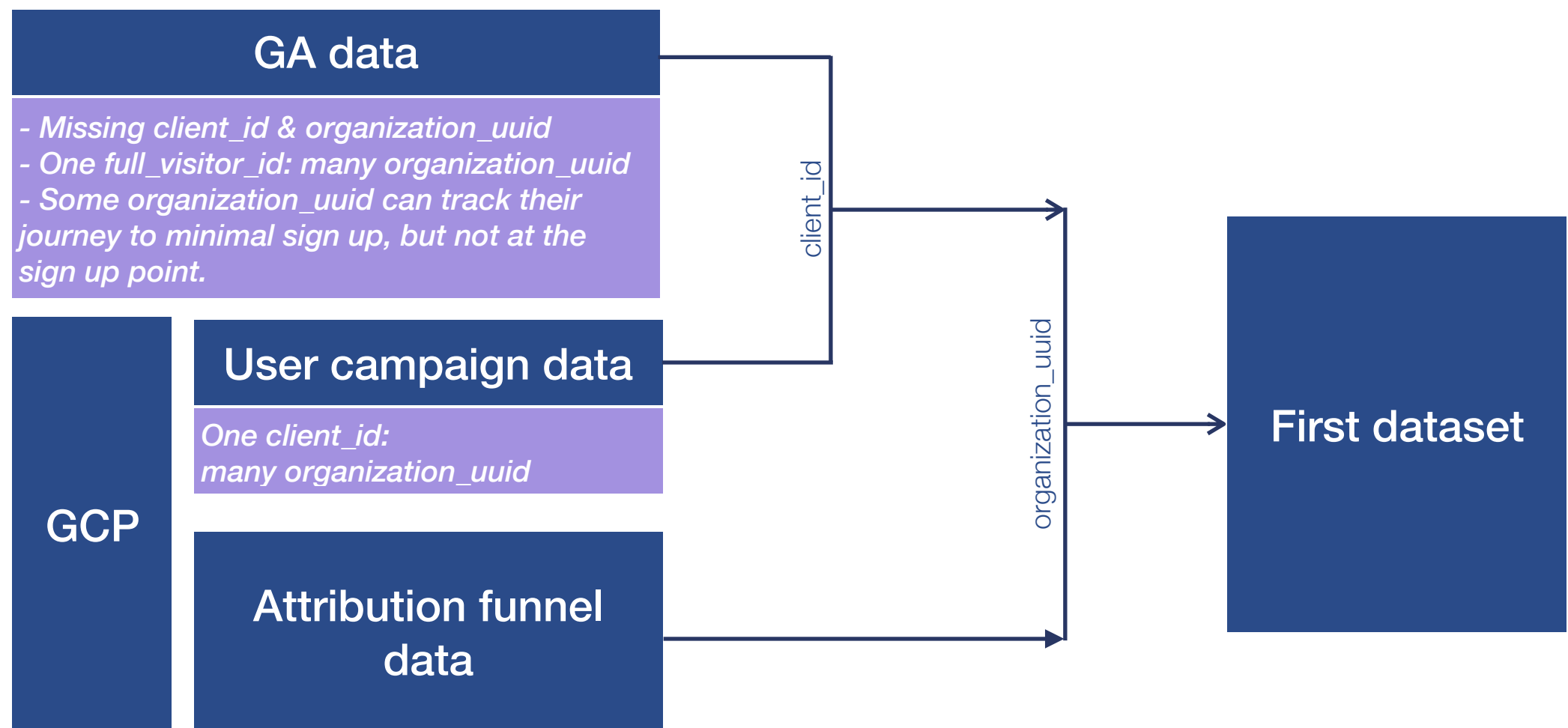6. Some cases can't record organization_uuid at minimal sign-up

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nr of sessions
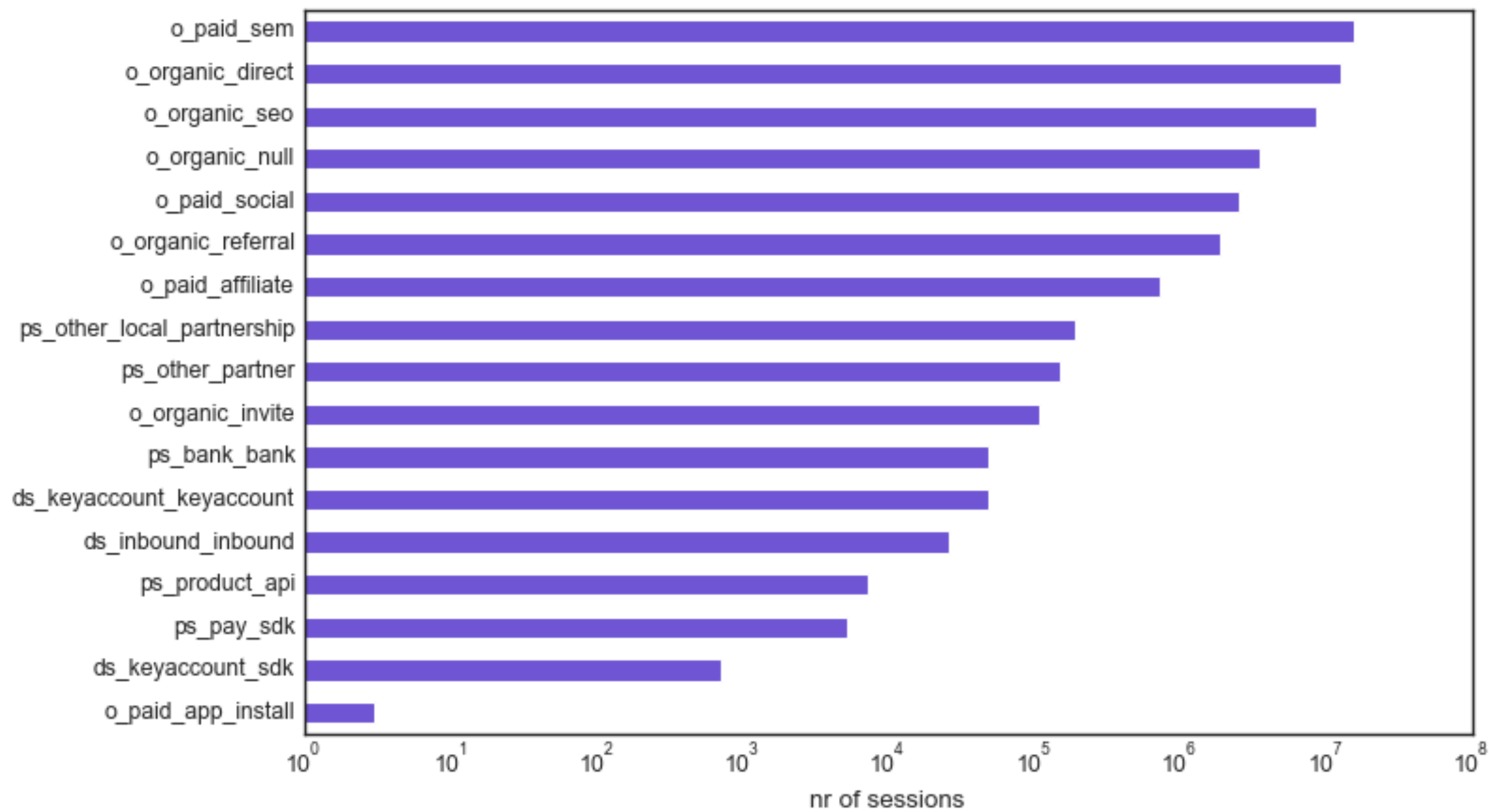
Create first attribution dataset

- Dataset = GA data + GCP
- GCP = user_campaign_data + attribution_funnel

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First dataset's challenges

GA data

- Missing client_id & organization_uuid
- One full_visitor_id: many organization_uuid
- Some organization_uuid can track their journey to minimal sign up, but not at the sign up point.

GCP

User campaign data

One client_id:
many organization_uuid

Attribution funnel data

client_id

organization_uuid

First dataset

Customer journey

	journey	nr_merchants	length
0	[o_paid_sem]	278539	1
1	[o_organic_null]	156363	1
2	[o_organic_direct]	142474	1
3	[o_organic_app]	99365	1
4	[o_organic_seo]	92065	1
...	...	...	...
481	[o_organic_app, o_paid_social, partnerships]	1	3
482	[o_organic_direct, o_organic_invite, o_organic...	1	4
483	[direct, o_organic_direct, o_organic_referral,...	1	5
484	[direct, o_paid_affiliate, partnerships]	1	3
577	[o_organic_null, o_organic_referral, o_paid_af...	1	5

· REG
nr_session = 1: 76.98%
nr_session <= 4: 95.87%
nr_session <= 40: 99.99%

· KYC
nr_session = 1: 68.44%
nr_session <= 4: 93.74%
nr_session <= 40: 99.98%

Journey length

Journey time of merchants
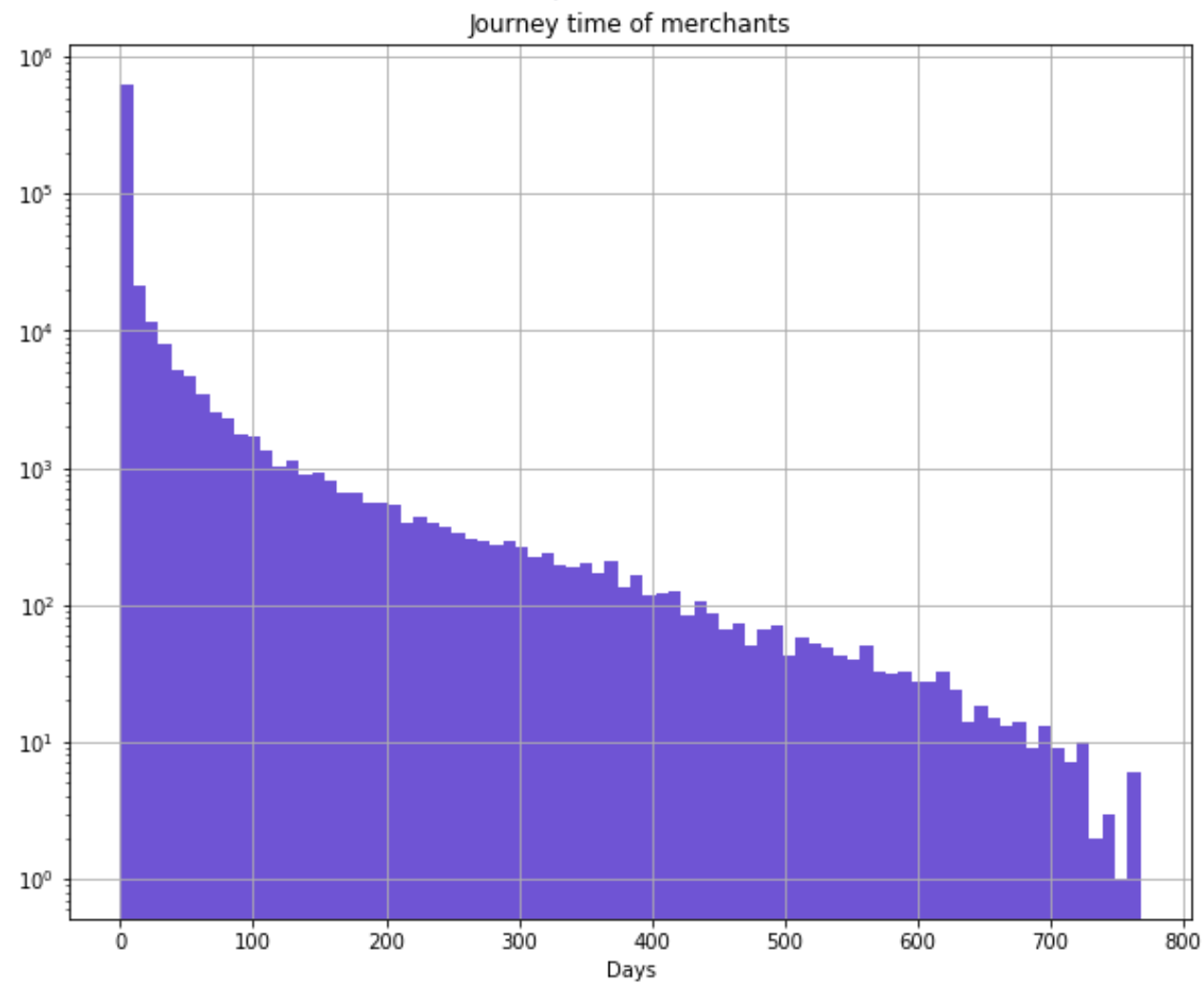
- ~50% of merchants register during the day they searched.

- ~60% of merchants register within 3 months of their search (11% >= 1 days)

- The rest: 38% of merchants we don't know their journey — we only know their last touch.
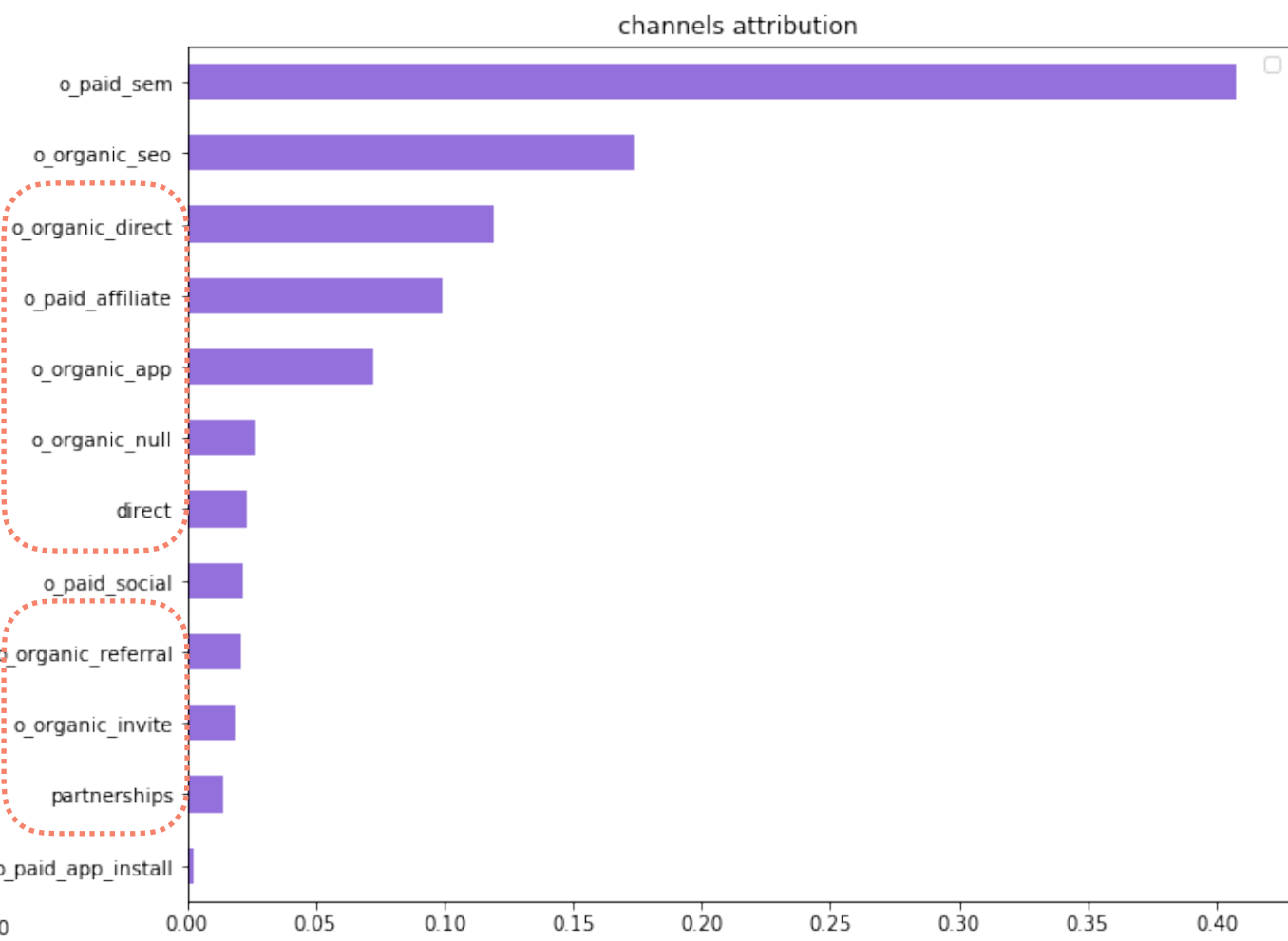
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Attribution models

- Base model: last touch point
- Data driven model: Shapley value
- Conversion: REG, KYC, ATC10

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Europe

Last touch: ATC10
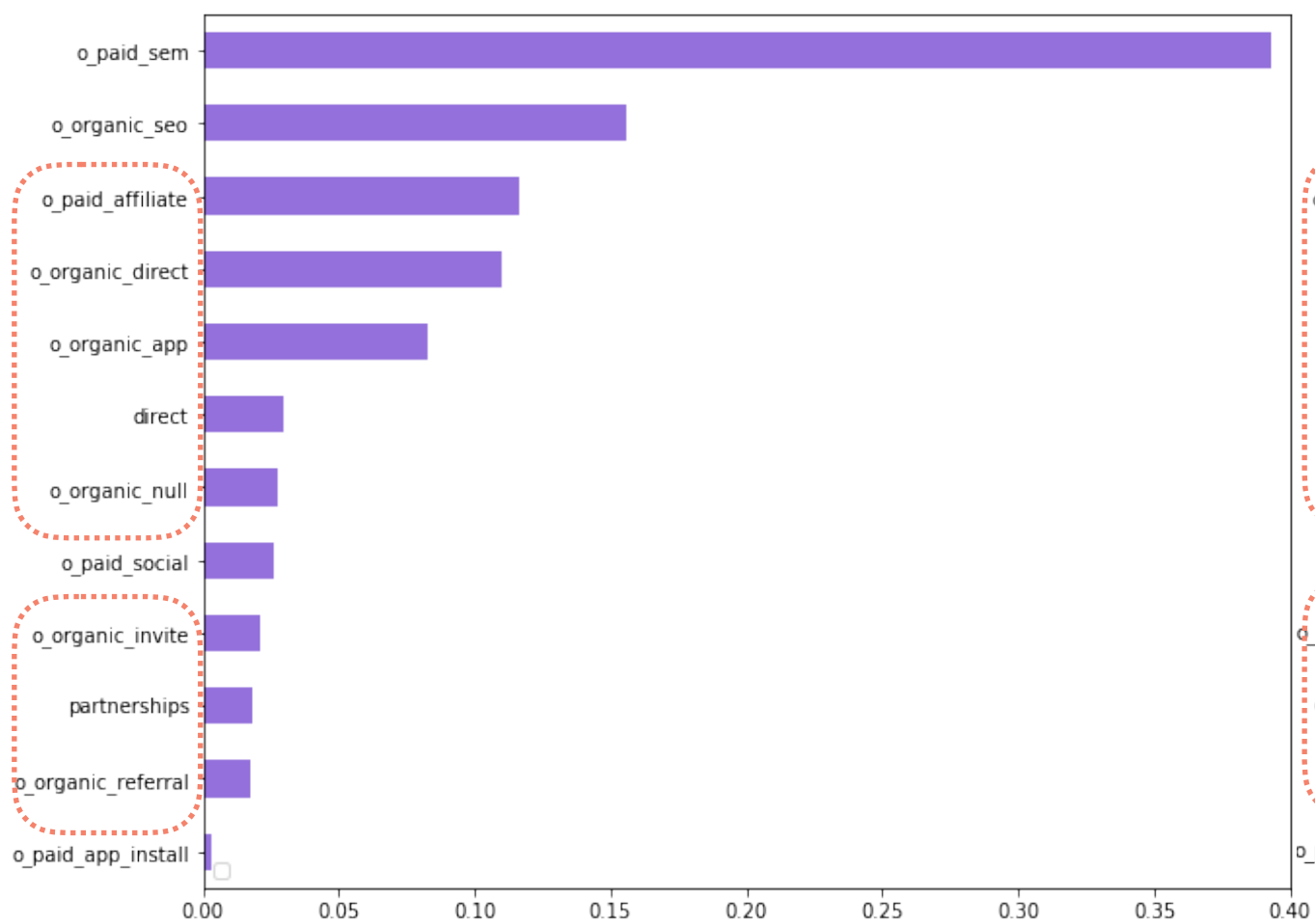
Shapley model: ATC10

Difference in ranking

Create second attribution dataset

Dataset =
Ga + GCP+ Fb+ Youtube + Google Display + expert's intuition

Second dataset's challenges

- Collect data manually from # sources: Fb, Google Display and Youtube
- Fb, Google Display and Youtube: aggregated data
- Assumptions

Thank you!

Farnaz Motamediyan

farnaz.m@izettle.com