



# Using Data Science to Solve Platform Problems at TrueCar

**TRUE**Car® Rachel Wang

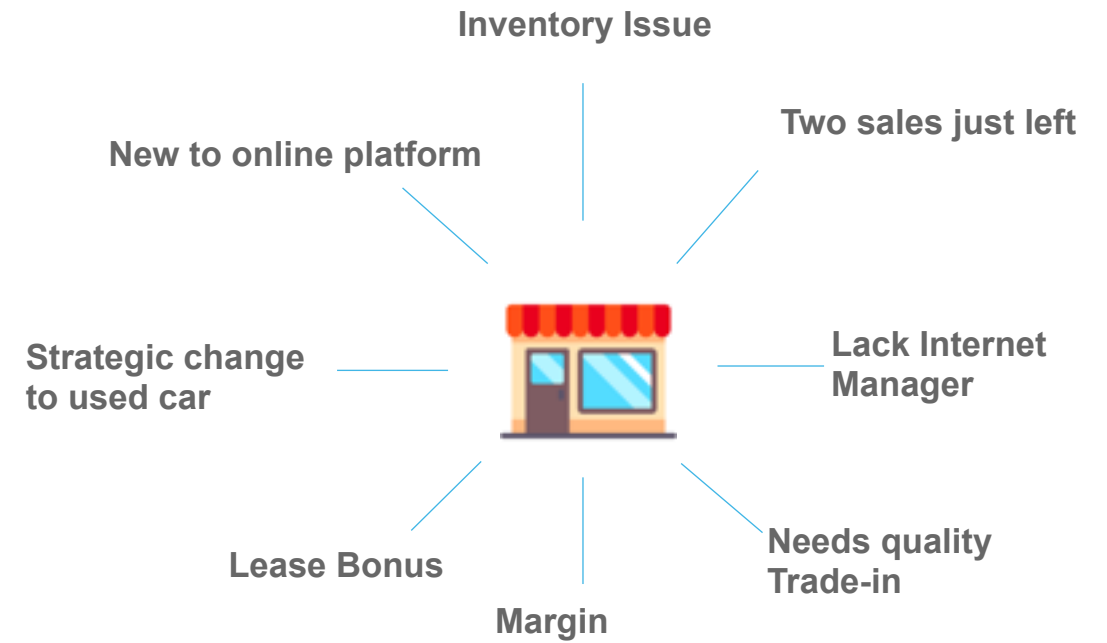
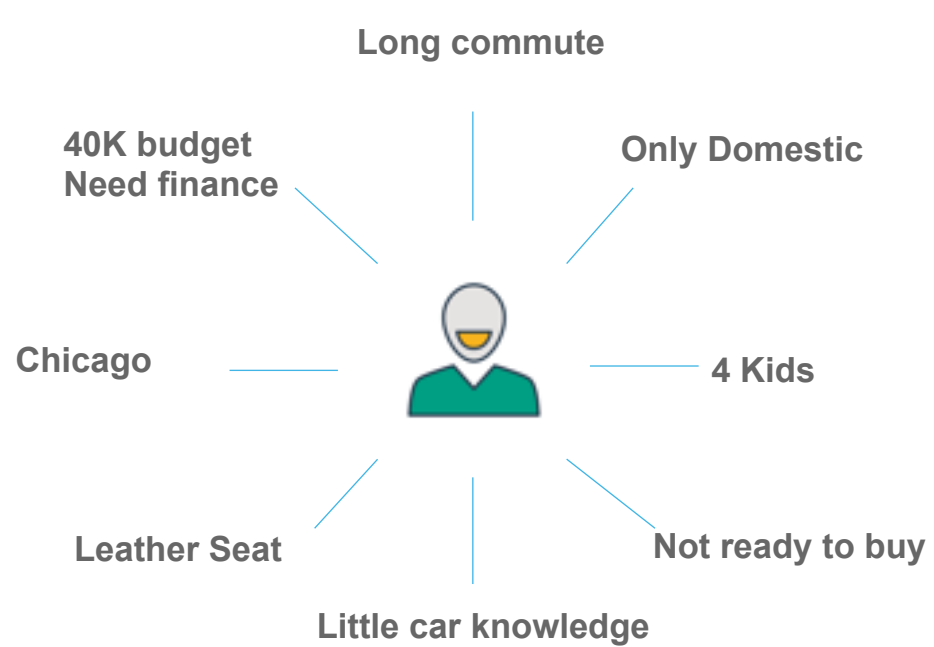


# Platform Problems in the Auto Industry



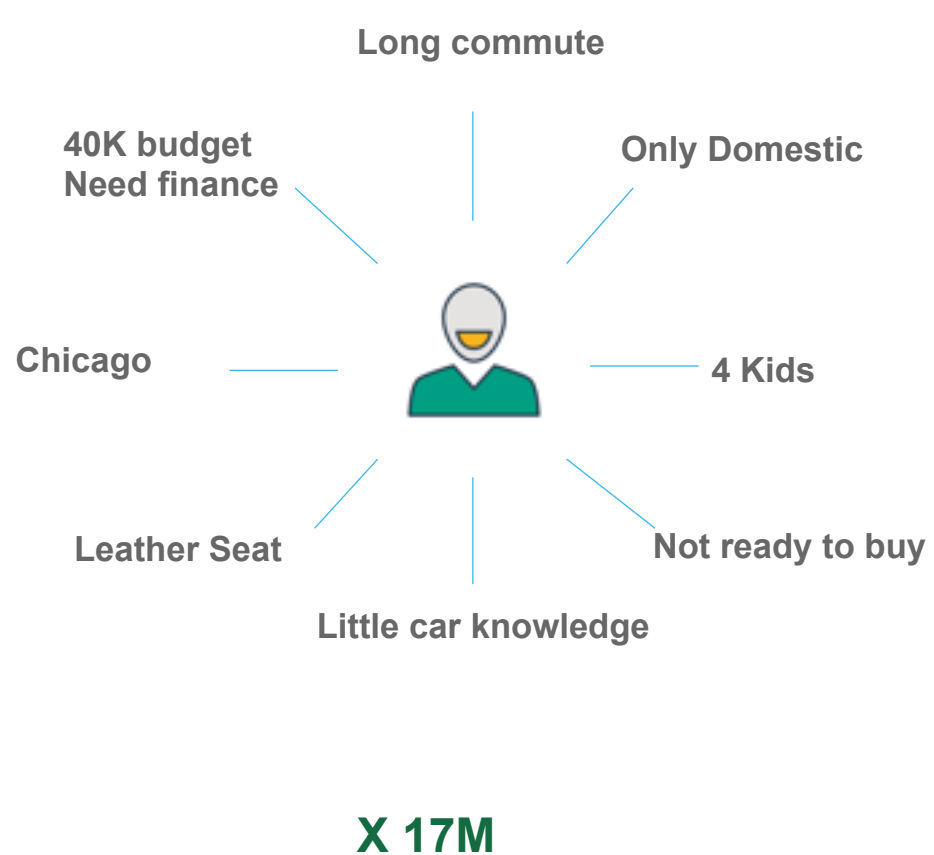
# Various Needs of Each Individual Adds Tremendous Complexity

---



# Various Needs of Each Individual Adds Tremendous Complexity

---



# A Marketplace Puzzle Only Can be Solved Through Data



Craigslist

# Platform problem is the perfect use case for modern Data Science

---



Data Science



# Platform Problems are generally...

## Classification

Customer Segmentation

## Recommendation

Recommending Trim/Dealers

## Optimization

Help dealer reduce time cost

## Allocation

Inventory Allocation

## Sorting & Ranking

Used Car Sorting

See what others paid near Los Angeles, CA



You can now get your TruePrice on inventory ×  
matching the vehicle of your choice.



**Santa Monica BMW**

Santa Monica, CA

(310) 697-8864



**South Bay BMW**

Torrance, CA

(310) 220-0617



**Pacific BMW**

Glendale, CA

(818) 254-1307

There are 3 dealers who should be  
contacting you shortly about your vehicle.

Take a moment to answer a few more  
questions for faster on-the-lot experience.



2018 BMW 3 Series  
330i Sedan

Your TruePrice  
\$43,390

MSRP: \$46,825

84% Match

Exp: 10/20/2018







# Platform Problem #1: Sorting



# Used Car Sort at TrueCar

How to rank the used vehicles in our inventory?

	<p>2013 Subaru Forester 2.5X Auto 29,330 miles • Long Beach, CA - 25 mi.</p> <p>Exterior: Dark Gray Metallic Interior: TITANIUM PEARL</p> <p>\$15,995</p>
	<p>2015 Subaru Forester 2.5i CVT (PZEV) 70,787 miles • Bellflower, CA - 24 mi.</p> <p>Exterior: Blue Interior: Gray</p> <p>\$13,998</p>
	<p>2018 Subaru Forester 2.5i Premium CVT 4,125 miles • Sherman Oaks, CA - 6 mi.</p> <p>Exterior: Dark Gray Interior: Gray</p> <p>\$24,400</p> <p>Certified Pre-Owned</p>
	<p>2015 Subaru Forester 2.5i CVT (PZEV) 122,207 miles • Huntington beach, CA - 39 mi.</p> <p>Exterior: Black Interior: Gray</p> <p>\$9,999</p>

Location

Los Angeles, CA

Distance

75 miles

Make

Subaru

Model

Forester

Trim

2.0XT Touring

Years

Min

to

Max

Price

\$7,000 - \$60,000

Mileage

25,000 - 181,000

Body Style

SUV

Exterior Color

Blue

Condition

All

MPG

20 - 25 MPG

Drive Type

AWD

Fuel Type

Gas

# Used Car Sort

How to rank the used vehicles in our inventory?

**Goal: show the most relevant vehicles to the top**

Used Cars Under \$68,000 for Sale

[See Listings Near Me](#)

Filter Your Results

LocationNationwide >

Distance75 miles ▾

MakeChevrolet ▾

ModelEquinox ▾

TrimL ▾

YearsMin ▾ to Max ▾


Price  
\$0 - \$68,000

Mileage  
0 - 123,000


Body StyleAll ▾

Showing 1 - 11 of 11 Listings


Sort ByBest Match ▾




2018 Chevrolet Equinox L with 1SM  
1,528 miles 📍 Milwaukee, OR  
Exterior: Silver Ice Metallic  
Interior: Medium Ash Gray  
**\$19,998**  
Upfront Price Available



2016 Chevrolet Equinox L FWD  
12,046 miles 📍 Fallston, MD  
Exterior: Black  
Interior: Light Titanium/Jet Black  
**\$17,985**  
Discount Available



2016 Chevrolet Equinox L FWD  
84,009 miles 📍 Somerset, WI  
Exterior: Tungsten Metallic  
Interior: Light Titanium/Jet Black  
**\$13,188**



2015 Chevrolet Equinox L FWD  
38,020 miles 📍 Roanoke Rapids, NC  
Exterior: silver topaz metallic  
Interior: jet black  
**\$14,500**

10

# Used Car Sort

How to rank the used vehicles in our inventory?

**Goal: show the most relevant vehicles to the top**

Clickstream Data

Filters

Vehicle

Clicks

Used Cars Under \$68,000 for Sale

[See Listings Near Me](#)

The screenshot displays a car listing interface. On the left, a 'Filter Your Results' sidebar includes dropdowns for Location (Nationwide), Distance (75 miles), Make (Chevrolet), Model (Equinox), Trim (L), and Years (Min to Max). It also features price and mileage sliders, both set to their maximum values (\$68,000 and 123,000 respectively), and a Body Style dropdown set to 'All'. The main area shows 'Showing 1 - 11 of 11 Listings' with a 'Sort By Best Match' option. Four vehicle listings are visible, each with a photo, title, mileage, location, and price. The first listing is a 2018 Chevrolet Equinox L with 1,528 miles for \$19,998. The second is a 2016 Chevrolet Equinox L FWD with 12,046 miles for \$17,985. The third is a 2016 Chevrolet Equinox L FWD with 84,009 miles for \$13,188. The fourth is a 2015 Chevrolet Equinox L FWD with 38,020 miles for \$14,500. Each listing also includes exterior and interior color details and a note about price availability.

Year	Make	Model	Trim	Mileage	Location	Price	Notes
2018	Chevrolet	Equinox	L with 1SM	1,528	Milwaukee, OR	\$19,998	Upfront Price Available
2016	Chevrolet	Equinox	L FWD	12,046	Fallston, MD	\$17,985	Discount Available
2016	Chevrolet	Equinox	L FWD	84,009	Somerset, WI	\$13,188	
2015	Chevrolet	Equinox	L FWD	38,020	Roanoke Rapids, NC	\$14,500	

# Used Car Sort

How to rank the used vehicles in our inventory?

**Goal: show the most relevant vehicles to the top**

**Clickstream Data: Filters, Vehicle, Clicks**

Used Cars Under \$68,000 for Sale [See Listings Near Me](#)

**Filter Your Results**

Location: **Nationwide**

Distance: **75 miles**

Make: **Chevrolet**

Model: **Equinox**

Trim: **L**

Years: **Min** to **Max**





Price: **\$0 - \$68,000**

Mileage: **0 - 123,000**

Body Style: **All**

Showing 1 - 11 of 11 Listings

Sort By: **Best Match**

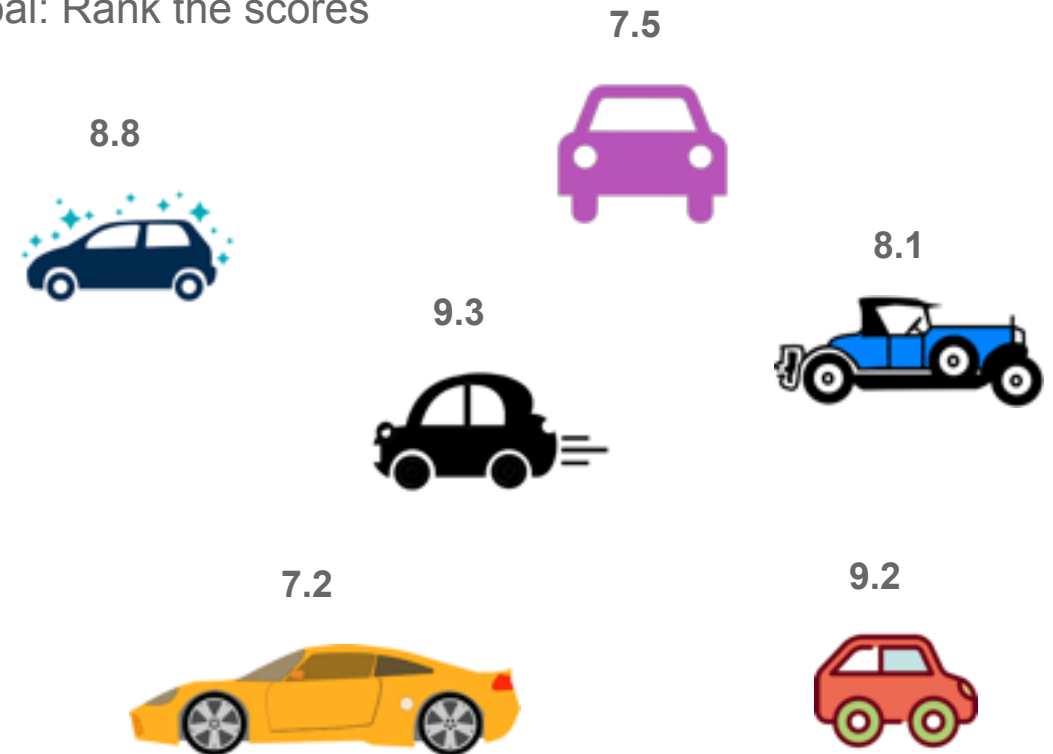
	<b>2018 Chevrolet Equinox L with 1SM</b> 1,526 miles • Milwaukee, WI Exterior: Silver Ice Metallic Interior: Medium Ash Gray <b>\$19,998</b> <small>Upright Price Available</small>
	<b>2016 Chevrolet Equinox L FWD</b> 12,046 miles • Fallston, MD Exterior: Black Interior: Light Titanium/Jet Black <b>\$17,985</b> <small>Discount Available</small>
	<b>2016 Chevrolet Equinox L FWD</b> 84,009 miles • Somerset, WI Exterior: Tungsten Metallic Interior: Light Titanium/Jet Black <b>\$13,188</b>
	<b>2015 Chevrolet Equinox L FWD</b> 38,020 miles • Roanoke Rapids, NC Exterior: silver topaz metallic Interior: jet black <b>\$14,500</b>

## Pointwise approach

Condition: Filters + Vehicle

Training Set: Click

Goal: Rank the scores



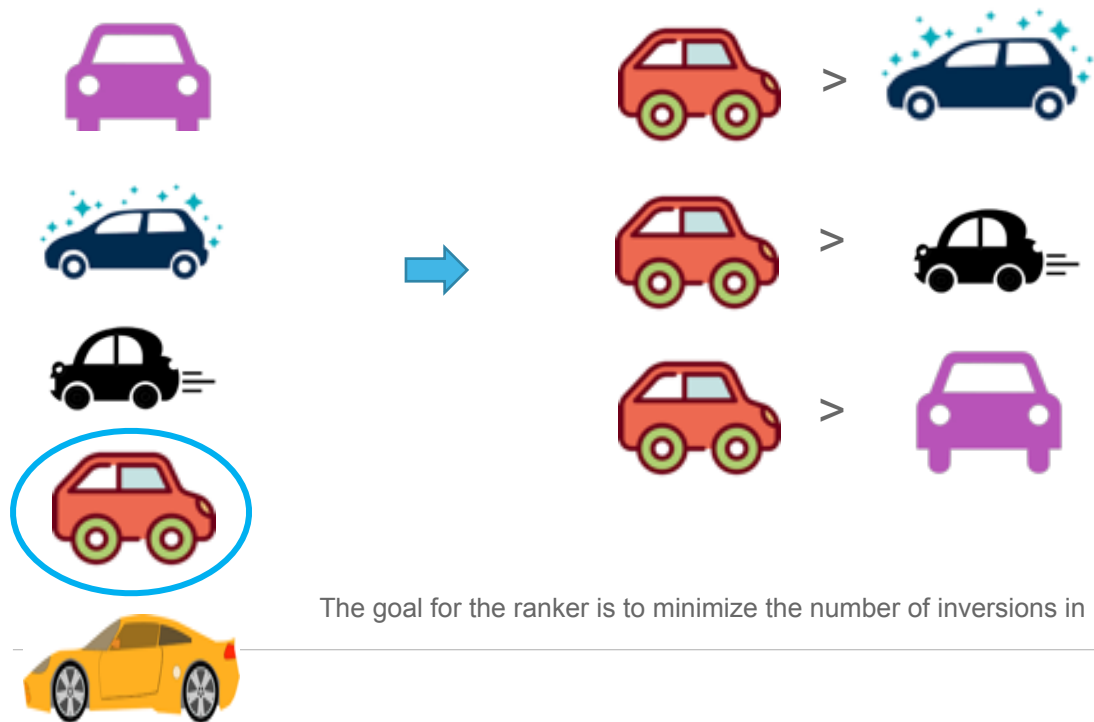
They essentially take a single car and train a classifier / regressor on it to predict how relevant it is for the current query. The final ranking is achieved by simply sorting the result list by these car scores. For pointwise approaches, the score for each car is independent of the other cars that are in the result list for the query



# Used Car Sort

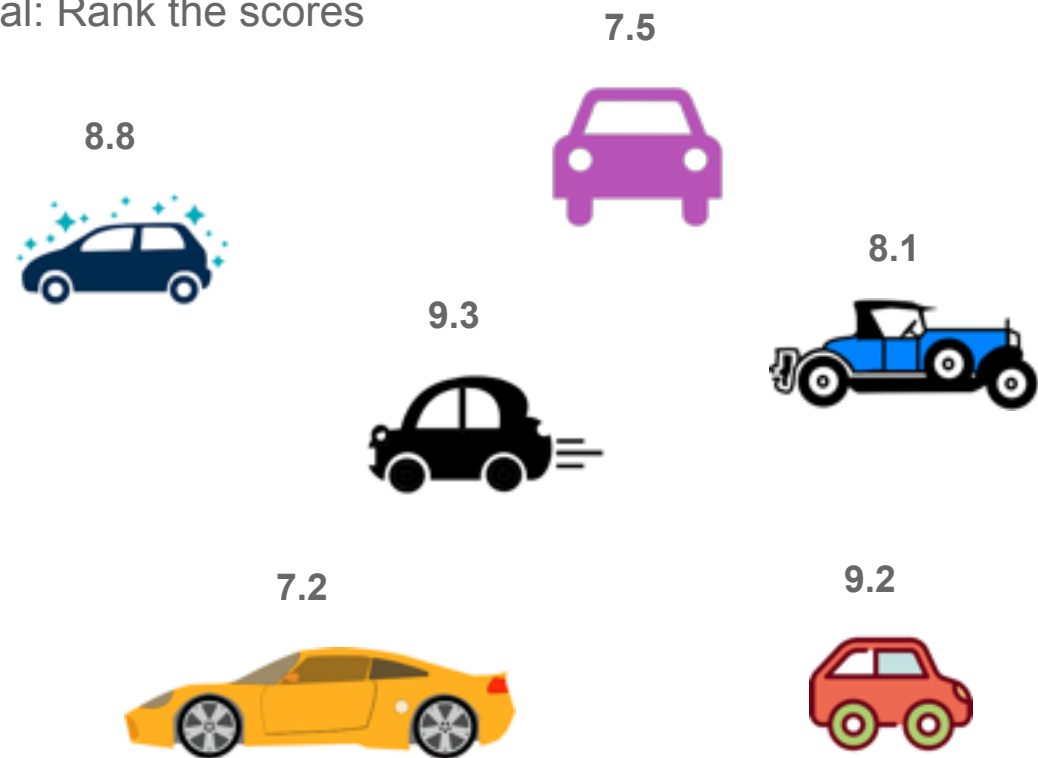
## Pairwise approach

Condition: Filters + Vehicle  
Training Set: Relative Position of A Pair of Cars  
Goal: Minimize the number of inversions



## Pointwise approach

Condition: Filters + Vehicle  
Training Set: Click  
Goal: Rank the scores



The goal for the ranker is to minimize the number of inversions in ranking i.e. cases where the pair of results are in the wrong order relative to the ground truth.

# Used Car Sort

---

## Pairwise approach

Condition: Filters + Vehicle

Training Set: Relative Position of A Pair of Cars

Goal: Minimize the number of inversions

## Pointwise approach

Condition: Filters + Vehicle

Training Set: Click

Goal: Rank the scores

## Improving?

Personalization, Real-time Adjustment

# Platform Problem #2: Market Simulation

# New Car Price Report Page

Shop New   Shop Used

Brand   Body Type

- |                             |            |               |
|-----------------------------|------------|---------------|
| Acura                       | GMC        | Mazda         |
| Alfa Romeo                  | Honda      | Mercedes-Benz |
| Audi                        | Hyundai    | MINI          |
| BMW                         | INFINITI   | Mitsubishi    |
| Buick <b>New BMW Models</b> | Jaguar     | Nissan        |
| Cadillac                    | Jeep       | Porsche       |
| Chevrolet                   | Kia        | Ram           |
| Chrysler                    | Land Rover | smart         |
| Dodge                       | Lexus      | Subaru        |
| FIAT                        | Lincoln    | Toyota        |
| Ford                        | Lotus      | Volkswagen    |
| Genesis                     | Maserati   | Volvo         |

## 2018 Toyota Camry Price Report

XSE V6 Automatic | 22/32 MPG (city/hwy) | ★★★★★ (1693)

[View 2019 Model](#) | [View Used Toyota Camry](#)



[Change Style](#) | [Colors & Options](#) | [View Incentives](#)

Retail Price	\$36,020
<small>MSRP/window sticker price</small>	
Market Average	\$33,280
<small>Avg. savings of \$2,740 Off MSRP</small>	
TruePrice	<a href="#">Get TruePrice</a>
<small>Discounted price you'll pay</small>	

[Get the TruePrice on Local Inventory](#)

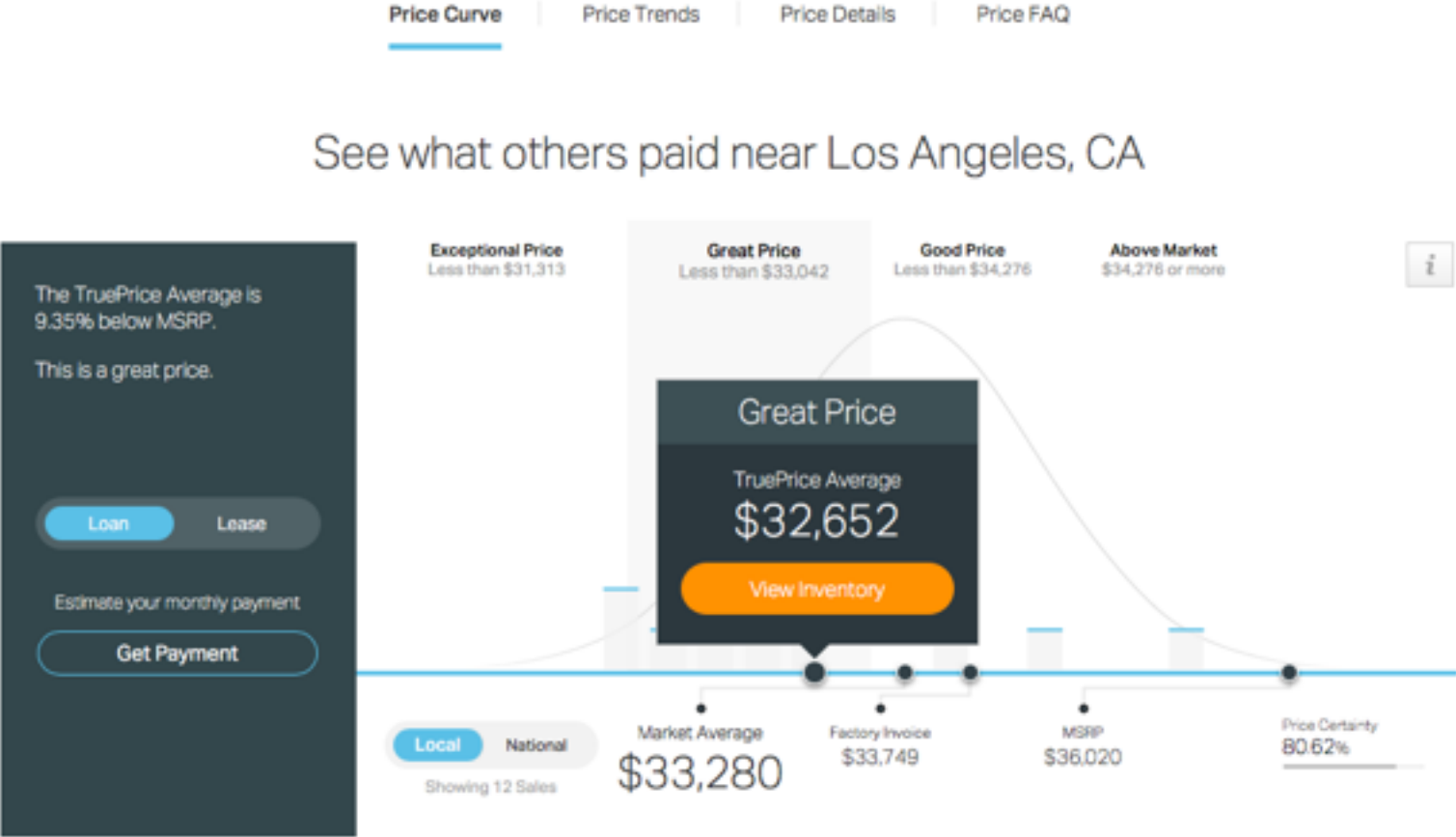
Prices   Gallery   Specs   Owner Reviews

### How TrueCar Works

1. See what others paid  
Price any car and compare that to what others paid.
2. Real Prices on Actual Cars  
View inventory and discounted prices before you visit the dealership.
3. Access TruePrice  
The price you will actually get—rebates and dealer fees included.



# New Car Price Report Page





**Using transaction data to mimic the auto market**  
for all makes, models, regions for all time

# New Car Price Model Problem for Data Science to solve

## 2018 Toyota Camry Price Report

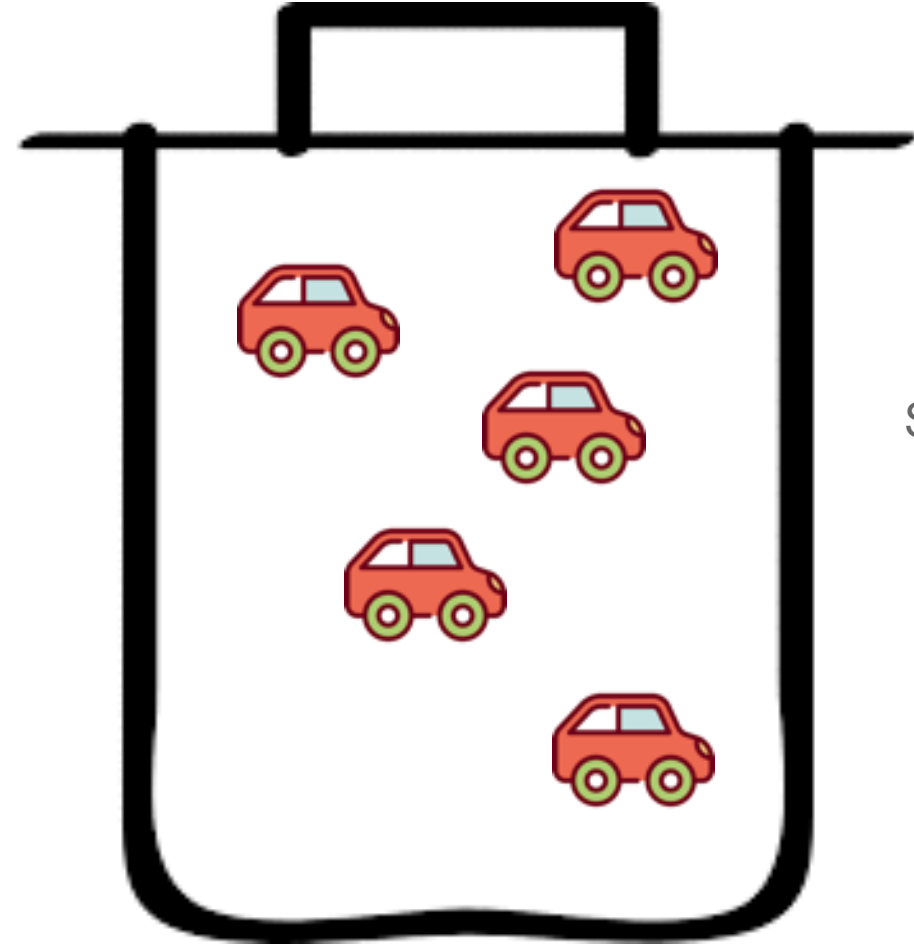
XSE V6 Automatic | 22/32 MPG (city/hwy) | ★★★★★ (1693) 

[View 2019 Model](#) | [View Used Toyota Camry](#)



## A Binning Approach

# New Car Price Model Problem for Data Science to solve



Simple Average



A Binning Approach



# Statistical Model vs. Machine Learning

---

Random Forest?

Clustering?

Neural Network?

**Easy to explain**

**Cost of Implementation**

**Visualization**

# Implementing Data Science to Platform Problems

---

**Classification**

**Recommendation**

**Optimization**

**Allocation**

**Sorting & Ranking**



**Understand the Business Need**

**Dance with Engineers**

**Know Your Audience**

**Automation Is Cool**

**Create Value**

# Questions?

---

