
DataRobot

Machine Learning for Gamers

Dungeon Forecasts & Dragon Regressions

DataRobot

Guy Royse

Developer Evangelist

DataRobot

guy.royse@datarobot.com

@guyroyse

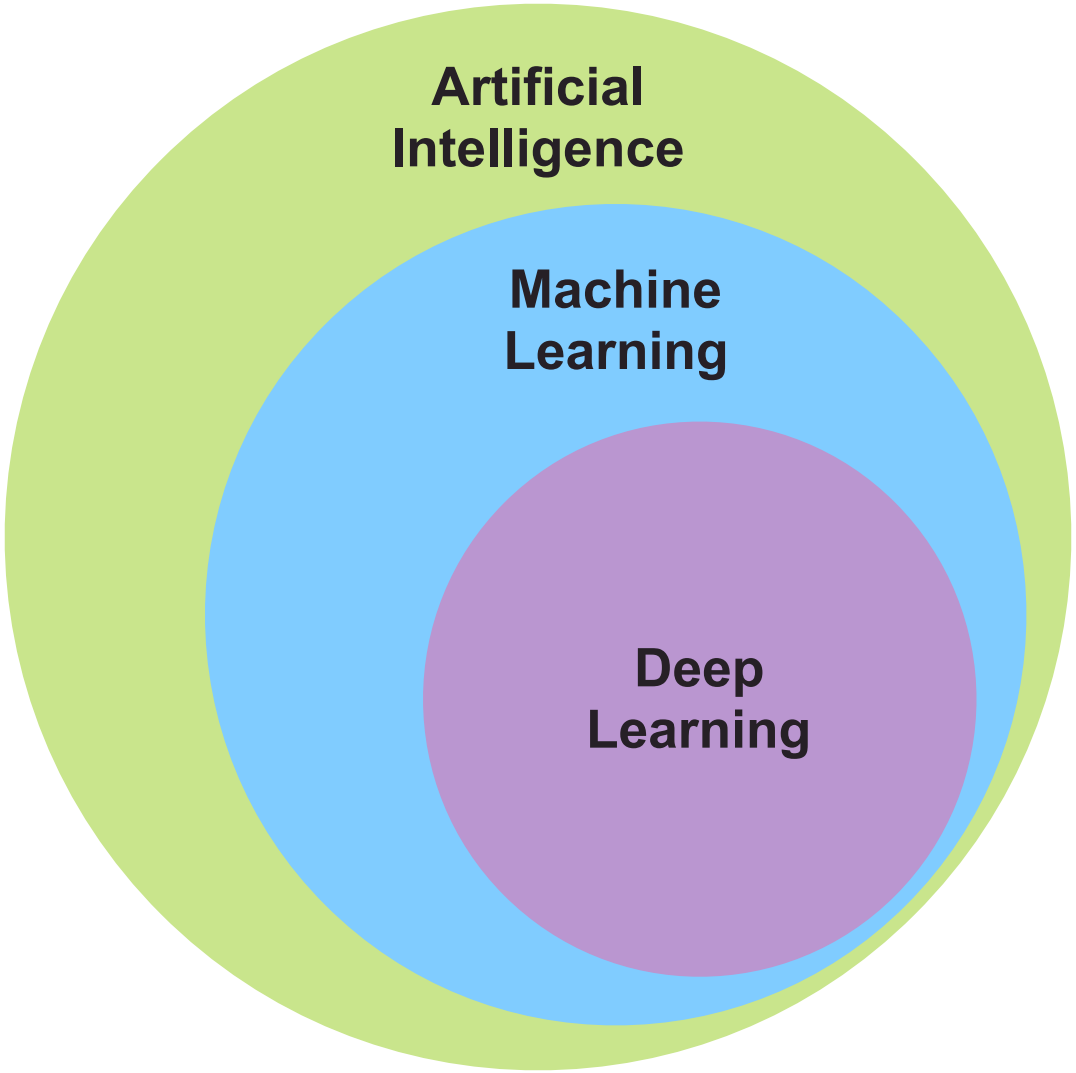
Name: Guy Royse
Class: Bard
Race: Dwarf
Level: 5
Alignment: Neutral good

Str: 10
Dex: 8
Con: 12
Int: 8
Wis: 8
Cha: 16

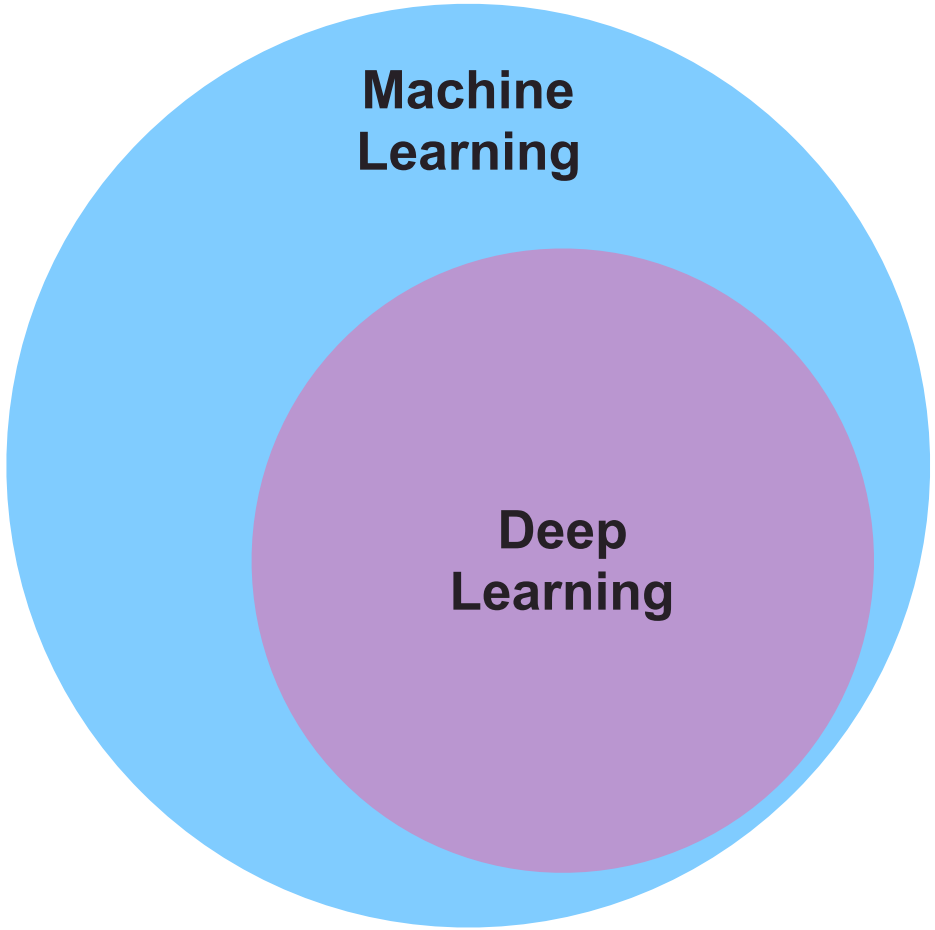
IANADS

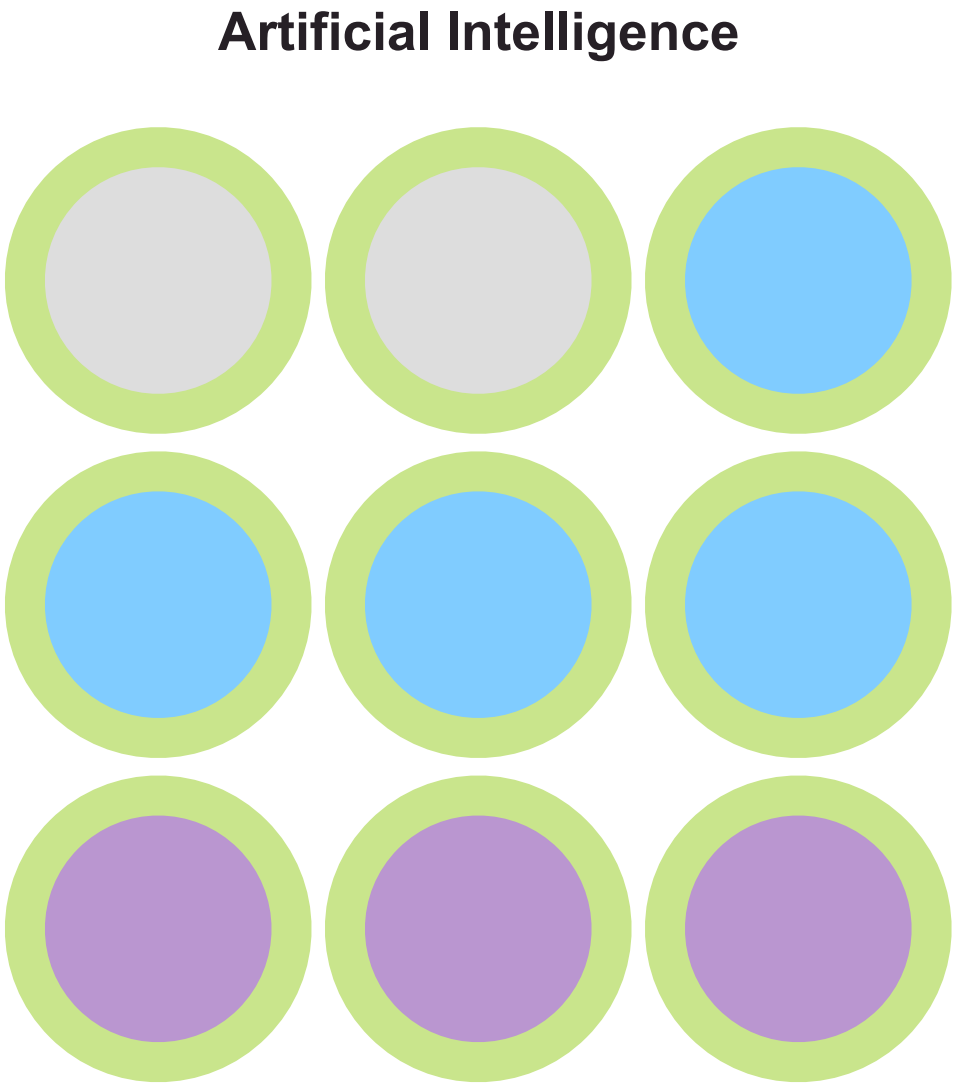
What is Machine Learning?

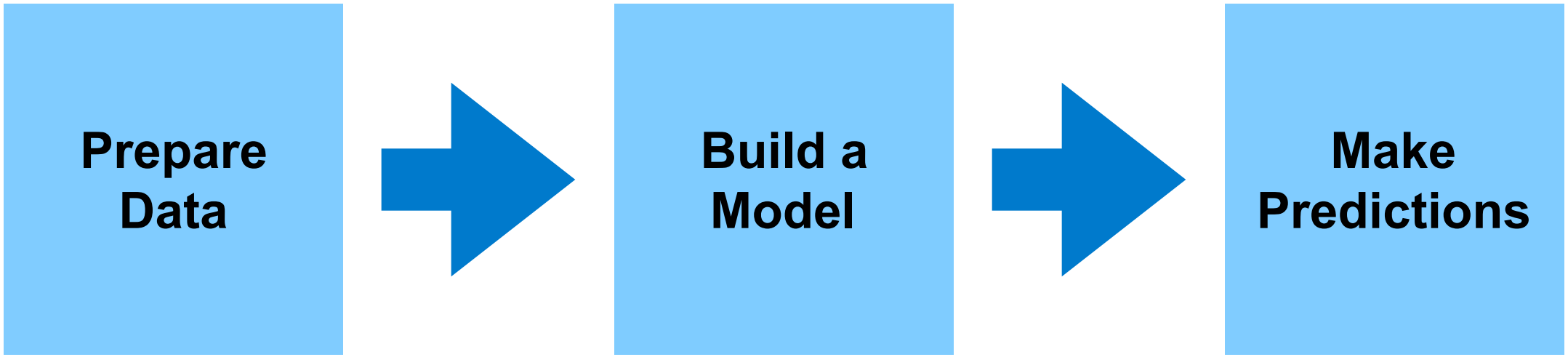
Some Definitions

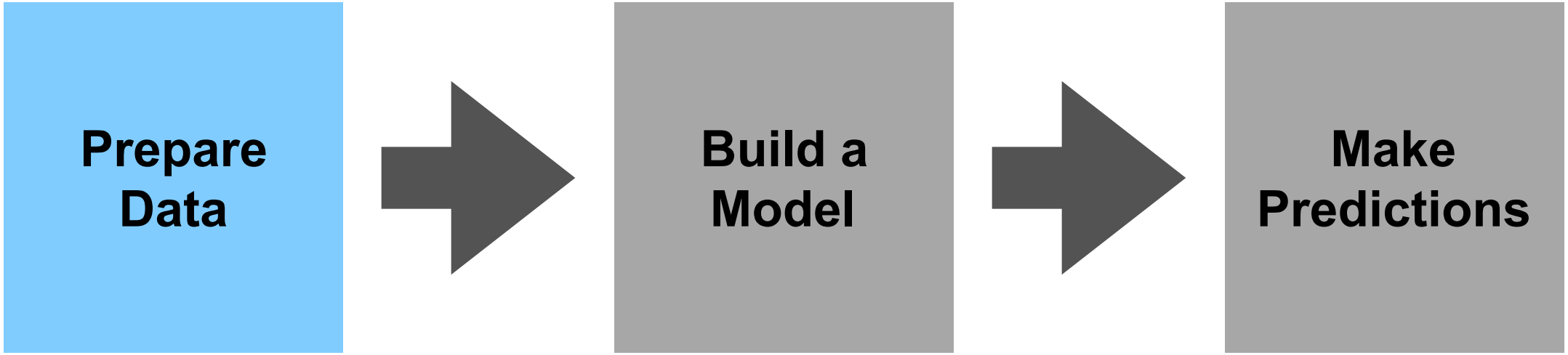


Some Alternate Definitions






Prepare Data
Build a Model
Make Predictions


Prepare Data
Build a Model
Make Predictions

Targets & Features

Target

The thing we want to predict

Features

Things that affect the thing we want to predict

Encoding & Imputation

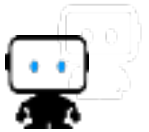
Encoding

Converting non-numeric data to numeric data

Imputation

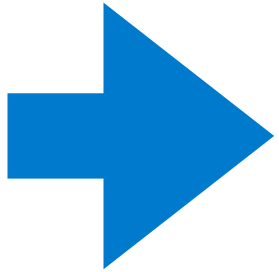
Replacing nulls in the data with meaningful replacements

Encoding



Boolean Encoding

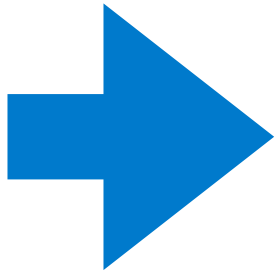
Goblinoid
Yes
No



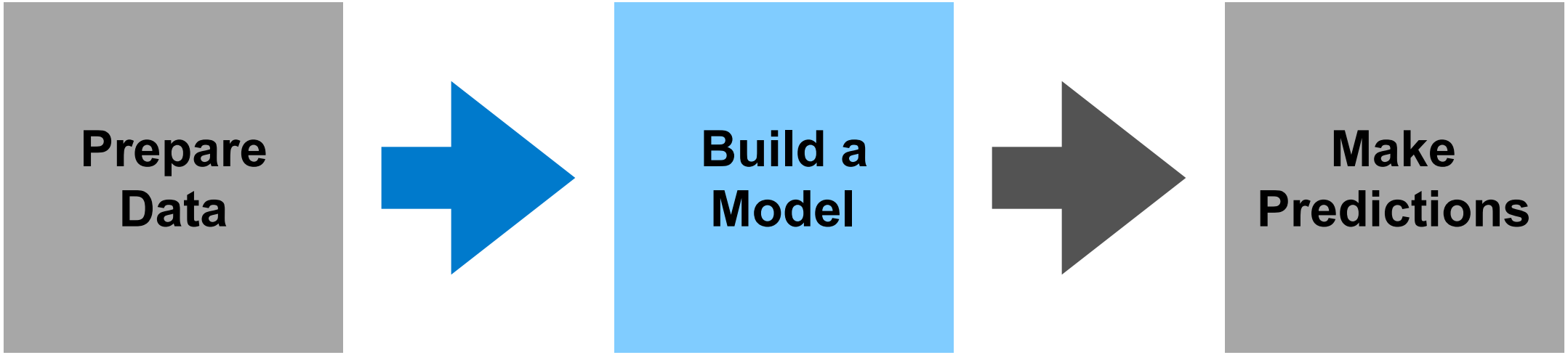
Goblinoid
1
0

One-Hot Encoding

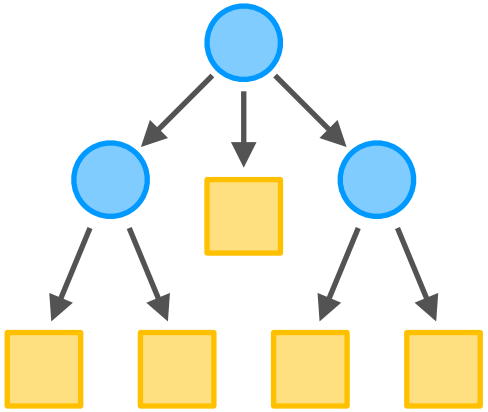
Dragon Color
Black
Blue
Green
Red
White



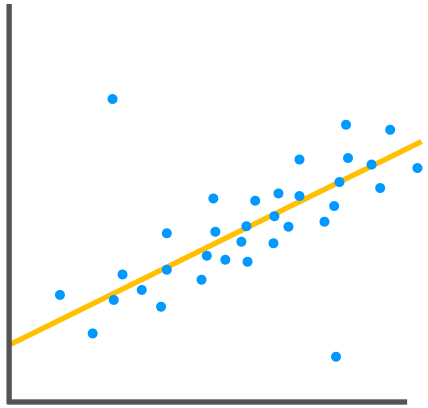
Black	Blue	Green	Red	White
1	0	0	0	0
0	1	0	0	0
0	0	1	0	0
0	0	0	1	0
0	0	0	0	1


Prepare Data
Build a Model
Make Predictions

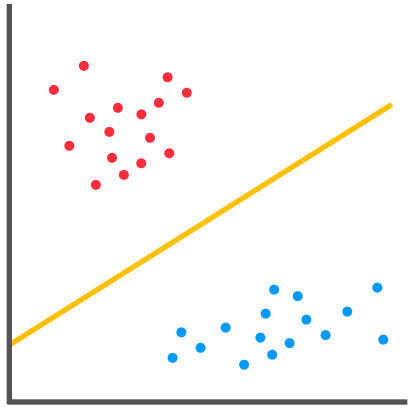
Algorithms



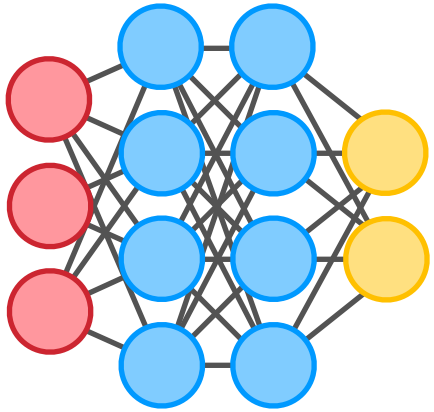
Decision Tree



Linear Regression

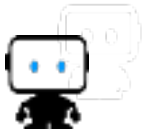


Support Vector Machine



Neural Network

Training & Testing



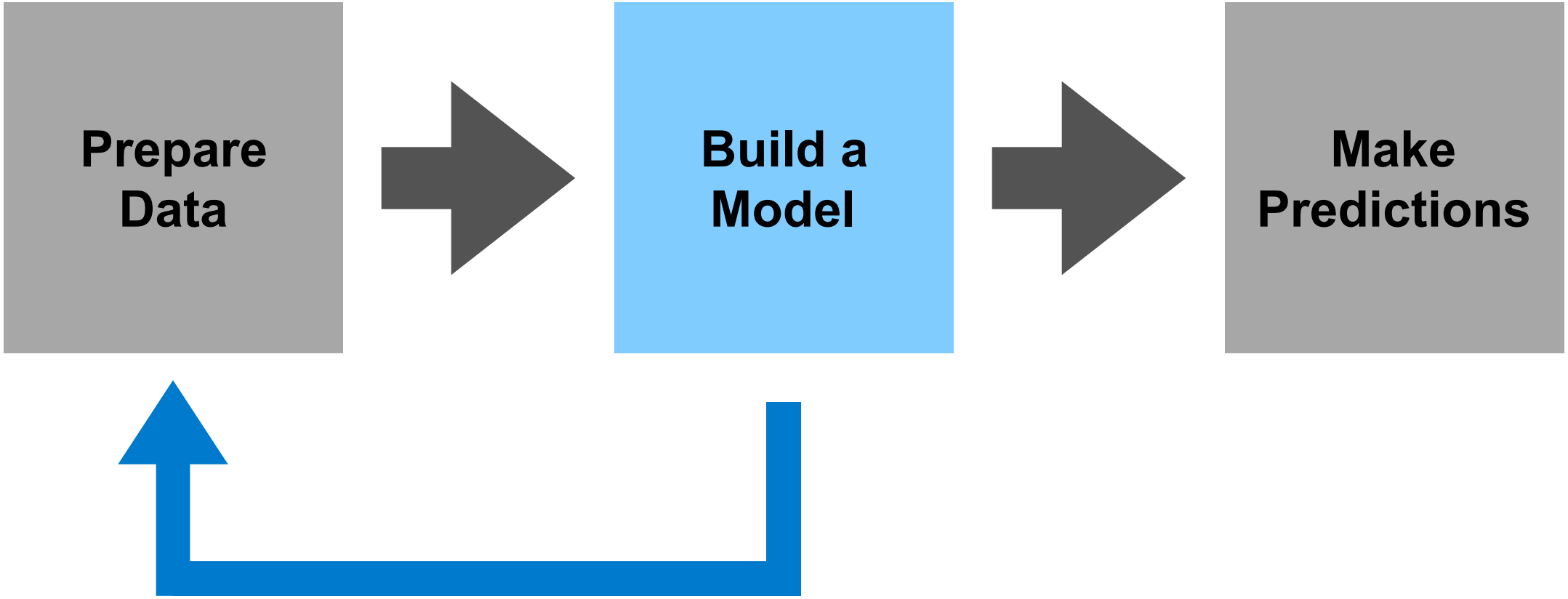
116	568	464	233	901	966	518	350	542	365
572	510	473	407	571	294	581	396	222	641
478	945	437	844	802	313	695	298	98	176
591	412	679	201	423	805	569	299	345	751
479	106	102	491	648	928	862	951	767	816
220	600	142	649	984	673	725	119	4	760
603	282	888	787	96	912	159	773	649	217
69	328	295	652	34	773	584	401	405	923
526	855	83	25	271	840	302	101	961	617
765	917	445	707	189	158	294	397	251	912
903	404	845	463	245	508	567	512	274	172
330	391	824	60	63	505	298	108	519	273
425	318	319	39	809	671	482	41	67	701
882	304	873	37	232	457	339	893	461	862
755	897	581	110	883	786	446	903	672	544

Training & Testing

116	568	464	233	901	966	518	350	542	365	Train Data 80%
572	510	473	407	571	294	581	396	222	641	
478	945	437	844	802	313	695	298	98	176	
591	412	679	201	423	805	569	299	345	751	
479	106	102	491	648	928	862	951	767	816	
220	600	142	649	984	673	725	119	4	760	
603	282	888	787	96	912	159	773	649	217	
69	328	295	652	34	773	584	401	405	923	
526	855	83	25	271	840	302	101	961	617	
765	917	445	707	189	158	294	397	251	912	
903	404	845	463	245	508	567	512	274	172	
330	391	824	60	63	505	298	108	519	273	
425	318	319	39	809	671	482	41	67	701	Test Data 20%
882	304	873	37	232	457	339	893	461	862	
755	897	581	110	883	786	446	903	672	544	

Cross Validation

116	568	464	233	901	966	518	350	542	365	20%
572	510	473	407	571	294	581	396	222	641	
478	945	437	844	802	313	695	298	98	176	
591	412	679	201	423	805	569	299	345	751	20%
479	106	102	491	648	928	862	951	767	816	
220	600	142	649	984	673	725	119	4	760	
603	282	888	787	96	912	159	773	649	217	20%
69	328	295	652	34	773	584	401	405	923	
526	855	83	25	271	840	302	101	961	617	
765	917	445	707	189	158	294	397	251	912	20%
903	404	845	463	245	508	567	512	274	172	
330	391	824	60	63	505	298	108	519	273	
425	318	319	39	809	671	482	41	67	701	20%
882	304	873	37	232	457	339	893	461	862	
755	897	581	110	883	786	446	903	672	544	


Prepare Data
Build a Model
Make Predictions

Target Leakage

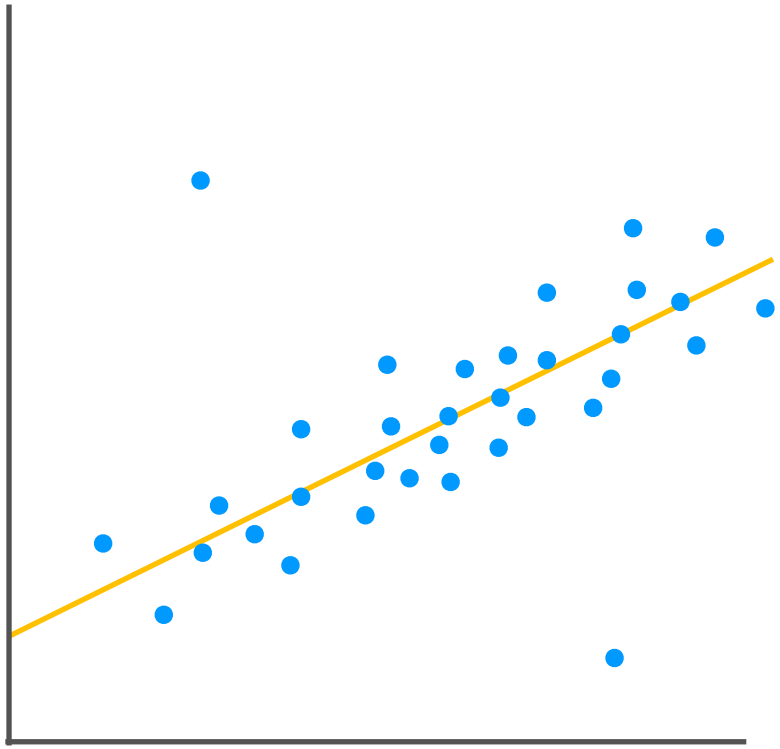
Target

The thing we want to predict

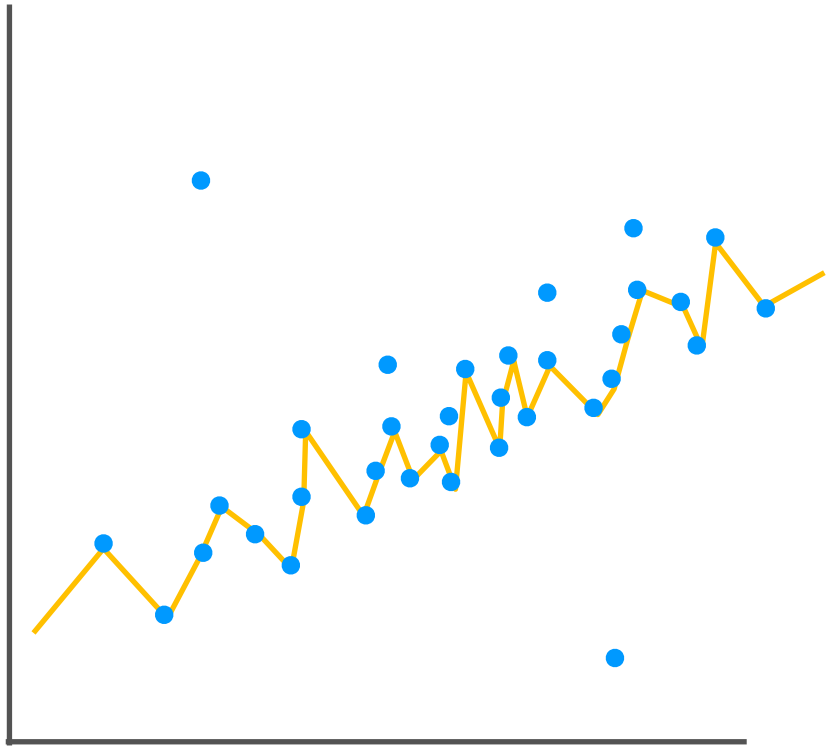
Leaky Features

Things that are part of the thing we want to predict

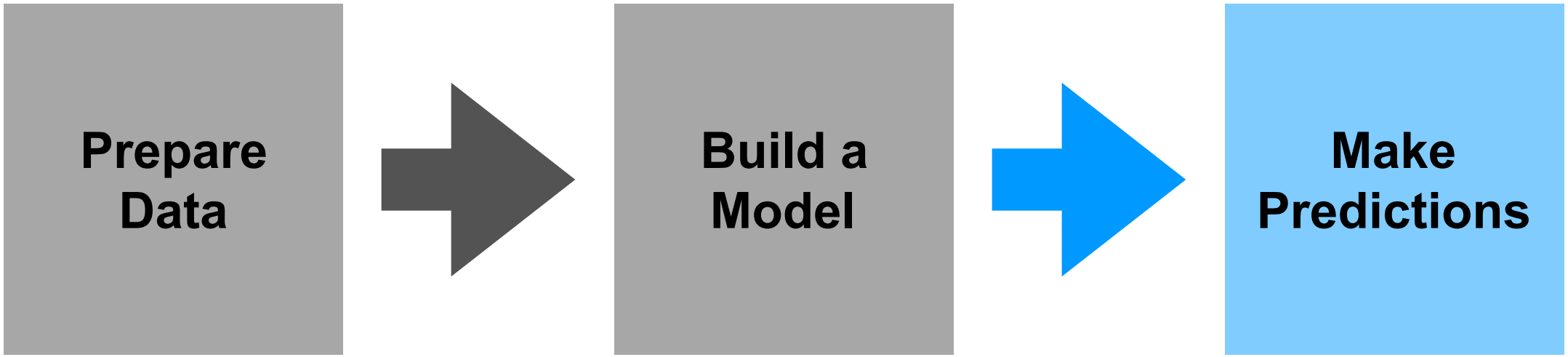
Overfitting



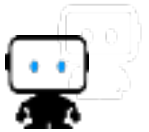
Fit



Overfit


Prepare Data
Build a Model
Make Predictions

Predictions



```
let features = [f1, f2, f3];
let prediction = model.predict(features);
```

Regression

Classification

Anomaly Detection

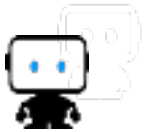
Forecasting

Impact Analysis

Regression

Determine the value of a dragon's hoard in gold pieces based on the age, color, and hit points of that dragon.

About Dragons



Age

Wyrmling
Young
Adult
Ancient

Color

Black
Blue
Green
Red
White
Brass
Bronze
Copper
Gold
Silver

Hit Points

How much damage the dragon can take until defeated

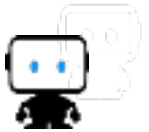
Hoard Value

Total value of all the dragon's treasure in gold pieces

The Data

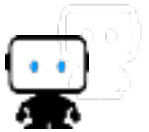
Age	Color	Hit Points	Hoard Value
Young	Gold	178	3,419.31
Ancient	Blue	481	105,630.42
Ancient	Green	385	107,355.23
Wyrmling	Green	38	233.15
Adult	Red	256	152,685.62
Adult	Brass	172	4,490.94
Young	Silver	168	2,786.95
Wyrmling	Copper	22	155.11
Young	Black	127	5,345.34
Adult	White	200	3,789.23
Wyrmling	Bronze	32	556.12
Ancient	Bronze	444	123,891.74
Adult	White	223	10,345.45

Asking the Question



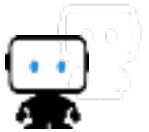
Age	Color	Hit Points	Hoard Value
Ancient	Gold	527	?

Asking the Question



Age	Color	Hit Points	Hoard Value
Ancient	Gold	?	129,459.14

Can I Ask This?

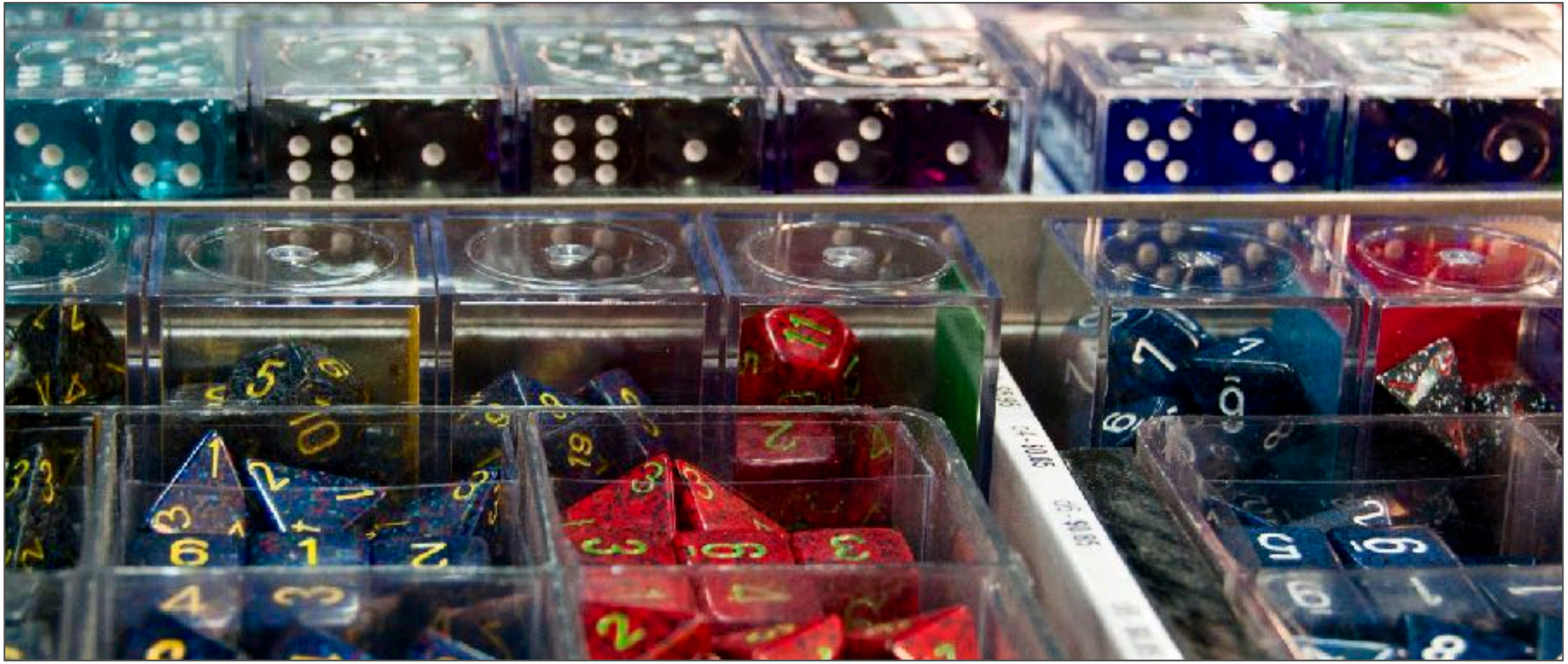


Age	Color	Hit Points	Hoard Value
Ancient	?	527	129,459.14

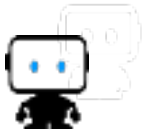
Age	Color	Hit Points	Hoard Value
?	Gold	527	129,459.14

Classification

Based on the six key abilities and race of a character, determine what class they should play.



About Characters



Abilities

Strength
Dexterity
Constitution
Intelligence
Wisdom
Charisma

Race

Elf
Dwarf
Halfling
Human
Gnome
Half-Elf
Half-Orc
Tiefling
Dragonborn

Class

Barbarian
Bard
Cleric
Druid
Fighter
Monk
Paladin
Ranger
Rogue
Sorcerer
Warlock
Wizard

The Data

Str	Dex	Con	Int	Wis	Cha	Race	Class
14	13	15	11	9	15	Half-Orc	Barbarian
8	12	15	13	11	12	Half-Elf	Rogue
12	10	15	16	5	10	Elf	Wizard
17	17	17	10	7	18	Dwarf	Fighter
15	15	14	11	11	13	Human	Fighter
13	8	14	5	12	17	Halfing	Bard
18	16	15	13	9	15	Halfling	Rogue
10	10	15	12	15	16	Tiefling	Warlock
18	11	10	12	12	11	Dwarf	Fighter
16	5	9	8	16	16	Human	Paladin
16	14	11	13	13	15	Dragonborn	Fighter
5	9	14	9	11	13	Human	Bard
10	12	7	15	15	10	Gnome	Cleric

Asking the Question

Str	Dex	Con	Int	Wis	Cha	Race	Class
14	13	15	11	9	15	Half-Orc	?

Barbarian	0.97184
Bard	0.83836
Cleric	0.81324
Druid	0.76682
Fighter	0.76646
Monk	0.64012
Paladin	0.5957
Ranger	0.5273
Rogue	0.44096
Sorcerer	0.27116
Warlock	0.18702
Wizard	0.07035

Asking the Question

Str	Dex	Con	Int	Wis	Cha	Race	Class
14	13	15	11	9	15	?	Cleric

Dwarf	0.97184
Elf	0.83836
Halfling	0.81324
Human	0.76682
Dragonborn	0.76646
Gnome	0.64012
Half-Elf	0.27116
Half-Orc	0.18702
Tiefling	0.07035

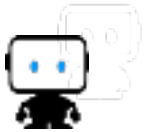
Anomaly Detection

Based on the six Based on the six key abilities, race, and class of a character, determine if that character is an outlier.

The Data

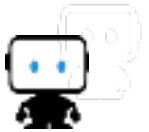
Str	Dex	Con	Int	Wis	Cha	Race	Class
14	13	15	11	9	15	Half-Orc	Barbarian
8	12	15	13	11	12	Half-Elf	Rogue
12	10	15	16	5	10	Elf	Wizard
17	17	17	10	7	18	Dwarf	Fighter
3	15	14	11	11	13	Human	Fighter
13	8	14	5	12	17	Halfing	Bard
18	16	15	13	9	15	Halfling	Rogue
10	10	15	12	15	16	Tiefling	Warlock
18	11	10	12	12	11	Dwarf	Fighter
16	5	9	8	16	16	Human	Paladin
16	14	11	13	13	15	Dragonborn	Fighter
5	9	14	9	11	3	Human	Bard
10	12	7	15	15	10	Gnome	Cleric

Detecting Anomalies



Str	Dex	Con	Int	Wis	Cha	Race	Class	Typicality
14	13	15	11	9	15	Half-Orc	Barbarian	0.18
8	12	15	13	11	12	Half-Elf	Rogue	0.06
12	10	15	16	5	10	Elf	Wizard	0
17	17	17	10	7	18	Dwarf	Fighter	0.36
3	15	14	11	11	13	Human	Fighter	-0.02
13	8	14	5	12	17	Halfing	Bard	0.02
18	16	15	13	9	15	Halfling	Rogue	0.36
10	10	15	12	15	16	Tiefling	Warlock	0.2
18	11	10	12	12	11	Dwarf	Fighter	0.12
16	5	9	8	16	16	Human	Paladin	0.04
16	14	11	13	13	15	Dragonborn	Fighter	0.28
5	9	14	9	11	3	Human	Bard	-0.34
10	12	7	15	15	10	Gnome	Cleric	0.02

Asking the Question

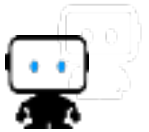


Str	Dex	Con	Int	Wis	Cha	Race	Class	Typicality
16	14	16	6	9	4	Half-Orc	Barbarian	?
8	8	8	18	16	10	Half-Orc	Barbarian	?

Forecasting

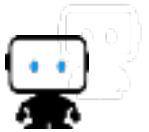
Predict the number of encounters that will be completed per weekly session for future weeks based on which players will be present and how long the session will last.

About Gaming Sessions



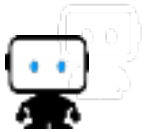
Date	Player's	Length	Encounters
When the session occurred	The players who attended the game for that particular session	Time spent playing during that particular game session	Number of completed combats for the session

The Data



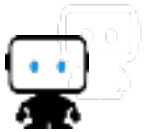
Date	Alice	Bob	Chuck	Eve	Length	Encounters
11/13/2016	Yes	Yes	Yes	Yes	4.00	4
11/20/2016	Yes	No	Yes	Yes	4.50	4
11/27/2016	Yes	Yes	Yes	Yes	3.25	3
12/4/2016	Yes	Yes	Yes	Yes	5.50	6
12/11/2016	Yes	Yes	Yes	No	12.00	8
12/18/2016	Yes	No	No	Yes	4.00	7
12/25/2016	No	No	No	No	0.00	0
1/1/2017	No	No	Yes	Yes	4.50	3
1/8/2017	Yes	Yes	Yes	Yes	7.00	5
1/15/2017	Yes	Yes	Yes	Yes	6.25	7
1/22/2017	Yes	Yes	No	Yes	6.00	8
1/29/2017	Yes	Yes	Yes	No	4.00	4
2/5/2017	Yes	Yes	Yes	Yes	3.75	3

Asking the Questions



Date	Alice	Bob	Chuck	Eve	Length	Encounters
2/12/2017	Yes	Yes	Yes	Yes	4.00	?
2/19/2017	Yes	Yes	Yes	Yes	4.00	?
2/26/2017	Yes	Yes	Yes	No	6.00	?

Asking the Question

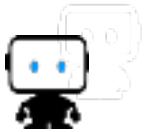


Date	Alice	Bob	Chuck	Eve	Length	Encounters
2/12/2017	Yes	Yes	Yes	Yes	?	4
2/19/2017	Yes	Yes	Yes	Yes	?	5
2/26/2017	Yes	Yes	Yes	No	?	4

Impact Analysis

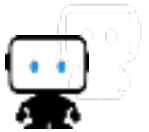
Measure the impact of updating your campaign from Pathfinder to 5th Edition.

The Data



Date	Alice	Bob	Chuck	Eve	Length	Encounters
11/13/2016	Yes	Yes	Yes	Yes	4.00	4
11/20/2016	Yes	No	Yes	Yes	4.50	4
11/27/2016	Yes	Yes	Yes	Yes	3.25	3
12/4/2016	Yes	Yes	Yes	Yes	5.50	6
12/11/2016	Yes	Yes	Yes	No	12.00	8
12/18/2016	Yes	No	No	Yes	4.00	7
12/25/2016	No	No	No	No	0.00	0
1/1/2017	No	No	Yes	Yes	4.50	3
1/8/2017	Yes	Yes	Yes	Yes	7.00	5
1/15/2017	Yes	Yes	Yes	Yes	6.25	7
1/22/2017	Yes	Yes	No	Yes	6.00	8
1/29/2017	Yes	Yes	Yes	No	4.00	4
2/5/2017	Yes	Yes	Yes	Yes	3.75	3

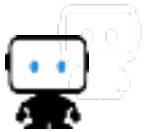
Asking the Question



Date	Alice	Bob	Chuck	Eve	Length	Encounters
1/1/2017	No	No	Yes	Yes	4.50	3
1/8/2017	Yes	Yes	Yes	Yes	7.00	5
1/15/2017	Yes	Yes	Yes	Yes	6.25	7
1/22/2017	Yes	Yes	No	Yes	6.00	8
1/29/2017	Yes	Yes	Yes	No	4.00	4
2/5/2017	Yes	Yes	Yes	Yes	3.75	3

Date	Alice	Bob	Chuck	Eve	Length	Encounters
1/1/2017	No	No	Yes	Yes	4.50	?
1/8/2017	Yes	Yes	Yes	Yes	7.00	?
1/15/2017	Yes	Yes	Yes	Yes	6.25	?
1/22/2017	Yes	Yes	No	Yes	6.00	?
1/29/2017	Yes	Yes	Yes	No	4.00	?
2/5/2017	Yes	Yes	Yes	Yes	3.75	?

Asking the Question



Date	Actual Encoutners	Predicted Encounters	Change
1/1/2017	3	5.0346	-2.0346
1/8/2017	5	8.391	-3.391
1/15/2017	7	11.7474	-4.7474
1/22/2017	8	13.4256	-5.4256
1/29/2017	4	6.7128	-2.7128
2/5/2017	3	5.0346	-2.0346

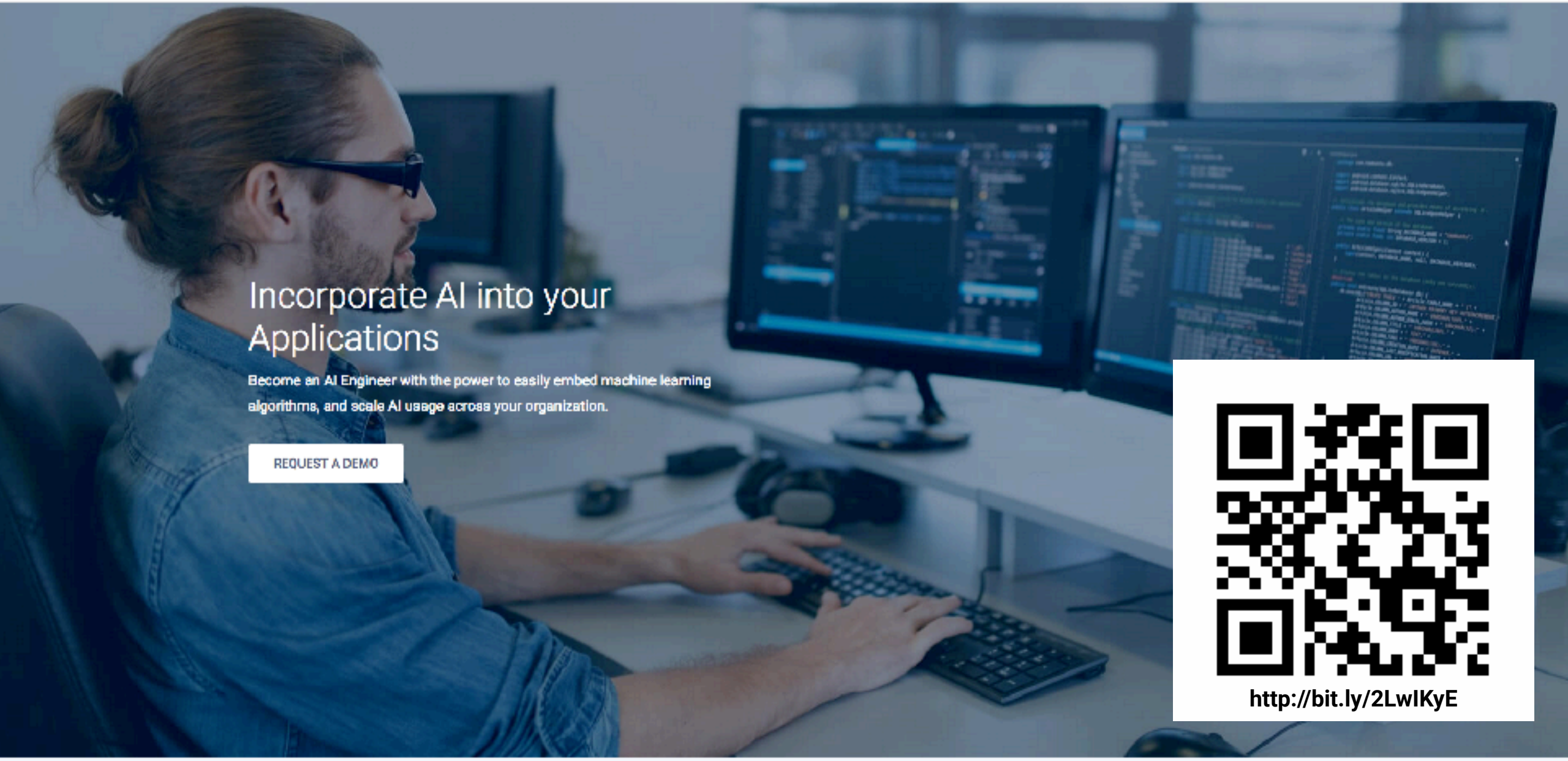
Regression

Classification

Anomaly Detection

Forecasting

Impact Analysis


DataRobot
PRODUCT
SOLUTIONS
LEARNING
PARTNERS
ABOUT
WE'RE HIRING
CONTACT US
Incorporate AI into your Applications
Become an AI Engineer with the power to easily embed machine learning algorithms, and scale AI usage across your organization.
REQUEST A DEMO
http://bit.ly/2LwIKyE

Questions?

Guy Royse

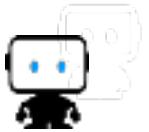
Developer Evangelist

DataRobot

guy.royse@datarobot.com

@guyroyse

Image Credits



https://www.flickr.com/photos/t17emma/5909350021

https://www.flickr.com/photos/rueink/35095791331

https://www.flickr.com/photos/rueink/37125691160

https://www.flickr.com/photos/fauxlaroid/5988373053

https://www.flickr.com/photos/kimonomania/602858091

https://www.flickr.com/photos/wonderferret/174314534

https://www.flickr.com/photos/herval/4100847043

https://www.flickr.com/photos/darkdwarf/7871533494


DataRobot