12 End-User-Friendly Explanatory Forms

Prototype Design Template

based on *EUCA: End-User-Centered Explainable AI Framework*

Website: http://weinajin.github.io/end-user-xai

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Explain using:

Explanatory Form & its Example

Supplementary information

Input

The image you uploaded:

Output

Predicted price of your own house

$ 650,000

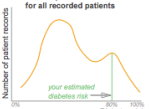
with certainty of 90%

$ 638 ~ 662,000

with certainty of 95%

Dataset

Distribution of predicted diabetes risk for all recorded patients



Performance

Overall performance of the autonomous driving mode:

*Measured using average distance driven between disengagements**

Under **normal** road condition: 40 km
During the **night**: 5 km
On **rainy** days: 3 km
On **snowy** days: 1 km

* Disengagement means when the automated system is switched off by the intervention of a human driver

Features

Feature Attribute

Important objects detected for the self-driving car's judgement:

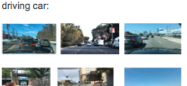
Feature Shape

Feature Interation

Examples

Similar Example

Similar traffic conditions as the current one, from the dataset to train the self-driving car:

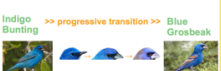


Typical Example

A **typical** house to sell at the estimated price as yours is like:

In your neighbourhood:
2 bedrooms
2 bathrooms
1000 sq
20 years old
.....

Counterfactual Example



Rules

Decision Rule

If **house area** ≤ 800 sq,
and **distance to school, parks** > 2.5 km,
Then house price **is no more than 600,000**

If **house area** is 800 - 900 sq,
and **distance to school, parks** < 2.5 km,
Then house price **is about 700,000-850,000**

Decision Tree

1. Supplementary Information

1.1 Input
1.2 Output
1.3 Dataset
1.4 Performance

The features of your current input:

- Feature 1
- Feature 2
- Feature 3
- ……

The features of your own house

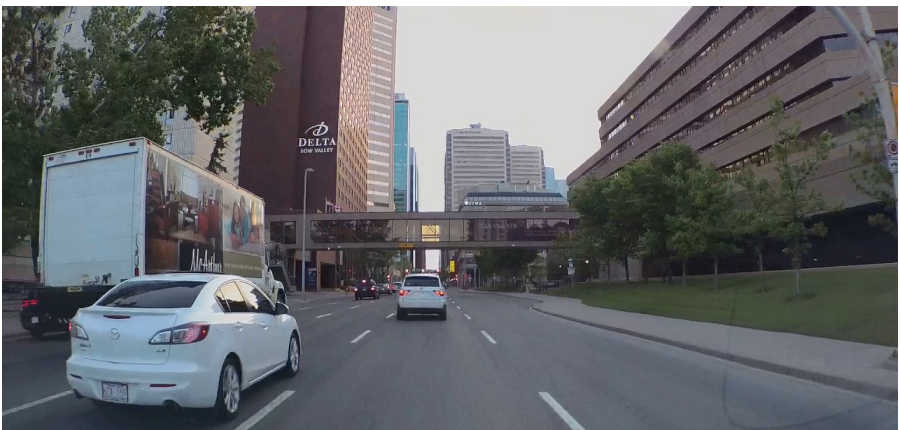
- 2 bedrooms
- 1 bathroom
- 780 sq
- 20 years old
- household appliances for 10 years
- distance to school, parks: 2 km

The data from your health records used for prediction:

- Male, 33 years old
- Three consecutive blood sugar level: normal, normal, higher than normal
- Body weight: 75 kg, height 175 cm
- Calories intake per day: 3200
- Minutes of exercise per week: 50 min
- Family history of diabetes: ……
- .....

The image you uploaded:

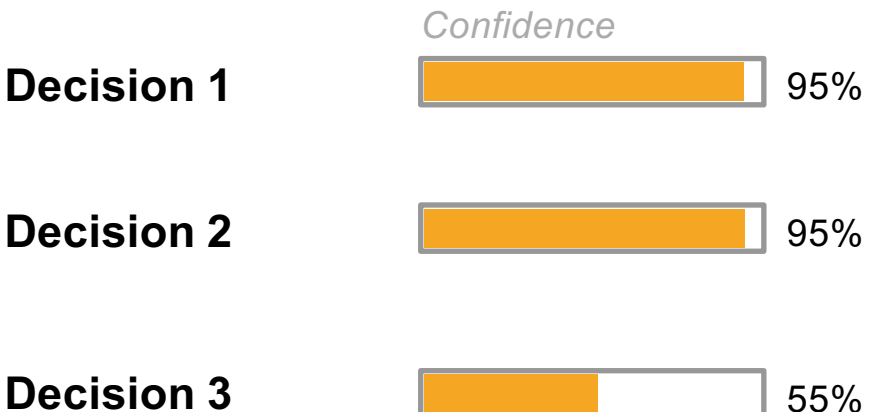
Current traffic view:



1. Supplementary Information

1.1 Input
1.2 Output
1.3 Dataset
1.4 Performance

AI's Decisions:



The current decisions, and **their percentage in the training dataset** where the AI learns from

	Confidence	*Precentage*	
Decision 1	95%	25%	
Decision 2	95%	34%	
Decision 3	55%	2.9%	

Your chance of getting diabetes within the next year is:

80 %

Predicted price of your own house

$ 650,000

Your chance of getting diabetes within the next year is:

80 %

with a certainty of 90%

75 ~ 85%

with a certainty of 95%

Predicted price of your own house

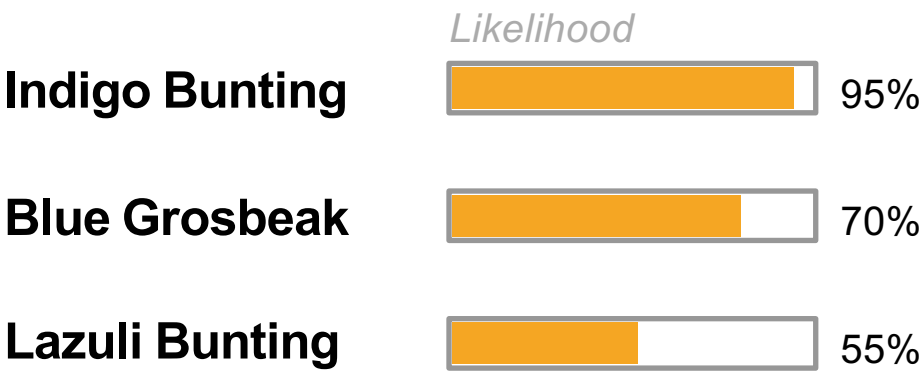
$ 650,000

with certainty of 90%

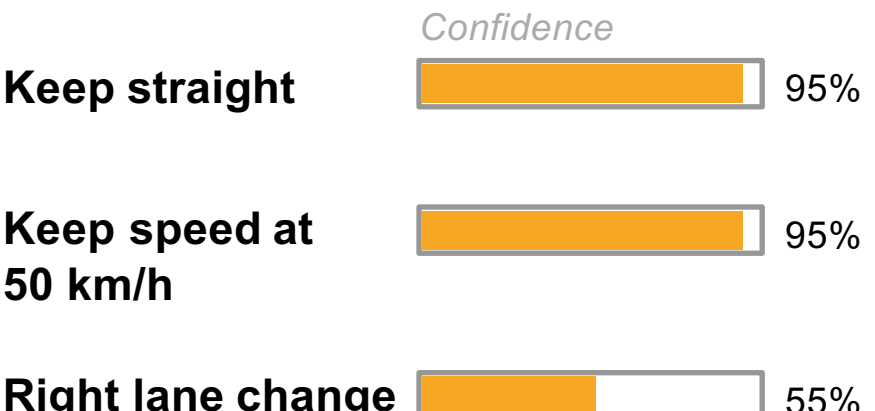
$ 638 ~ 662,000

with certainty of 95%

The image you uploaded is recognized as:



Driving decisions under the current traffic:



The three most likely bird according to your uploaded image, and **their percentage in the training dataset** where the AI learns from

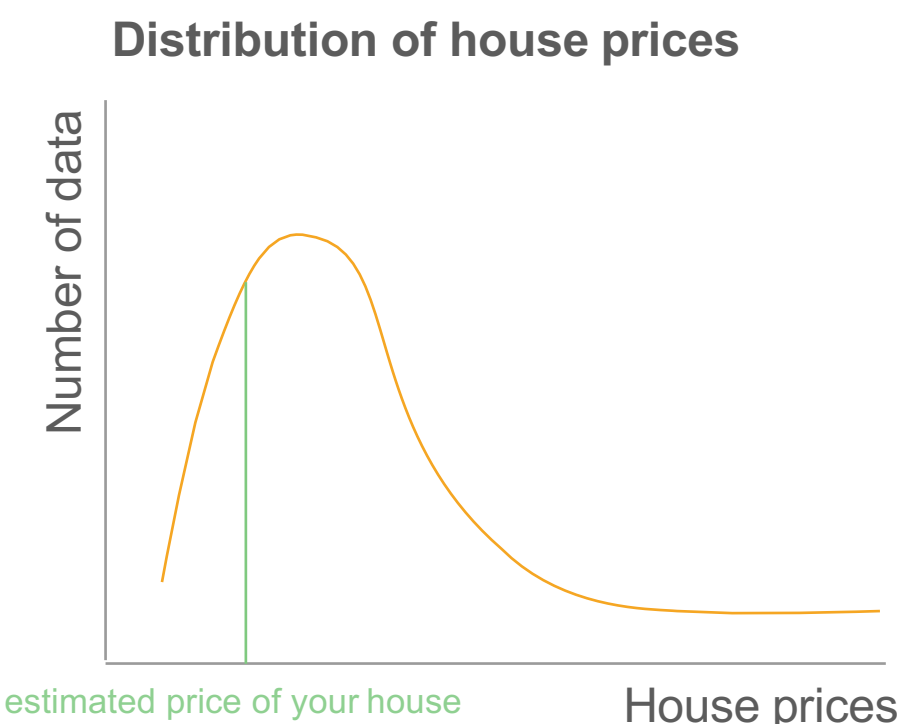
	Likelihood	*Precentage*	
Indigo Bunting	95%	1.5%	
Blue Grosbeak	70%	1.2%	
Lazuli Bunting	55%	1.3%	

The current driving decisions, and **their percentage in the training dataset** where the self-driving car learns from

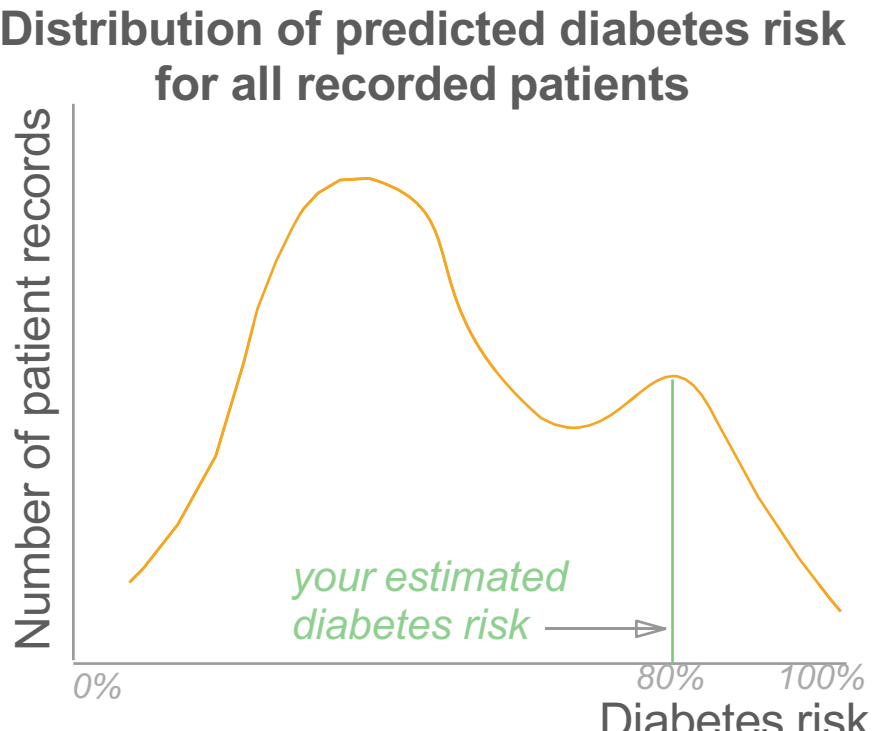
	Confidence	*Precentage*	
Keep straight	95%	25%	
Keep current speed	95%	34%	
Right lane change	55%	2.9%	

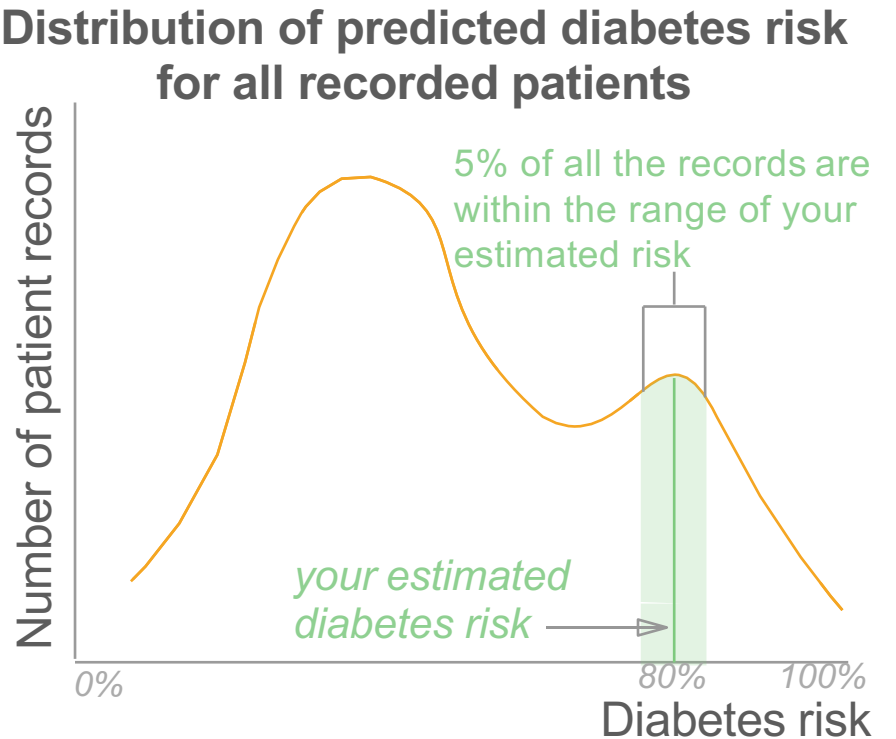
1. Supplementary Information

1.1 Input
1.2 Output
1.3 Dataset
1.4 Performance


Distribution of house prices
Number of data
estimated price of your house
House prices

Distribution of house prices


Distribution of predicted diabetes risk for all recorded patients
Number of patient records
your estimated diabetes risk
0%
80%
100%
Diabetes risk


Distribution of predicted diabetes risk for all recorded patients
Number of patient records
5% of all the records are within the range of your estimated risk
your estimated diabetes risk
0%
80%
100%
Diabetes risk

1. Supplementary Information

1.1 Input
1.2 Output
1.3 Dataset
1.4 Performance

Overall performance of the AI :

- Accuracy: 85%
- Error rate: 15%

Overall performance of the AI bird recognition tool:

- Accuracy: 85%
- Error rate: 15%

Overall performance of the autonomous driving mode:

*Measured using average distance driven between disengagements**

- Under **normal** road condition: 40 km
- During the **night**: 5 km
- On **rainy** days: 3 km
- On **snowy** days: 1 km

* Disengagement means when the automated system is switched off by the intervention of a human driver

The performance of the AI tool to predict diabetes risk

- Mean prediction error: ± 15%
- Max prediction error: ± 30%
- The AI tool can explain 75% of the variation in the training data

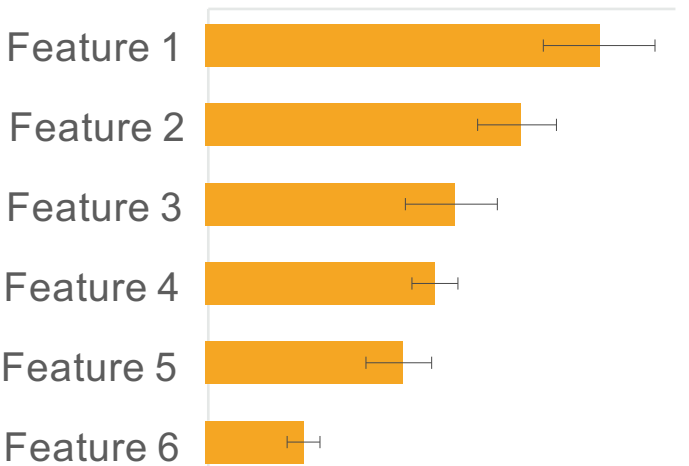
The performance of the AI house precdiction tool

- Mean prediction error: ± 50,000
- Max prediction error: ± 120,000
- The AI tool can explain 95% of the variation in the training data

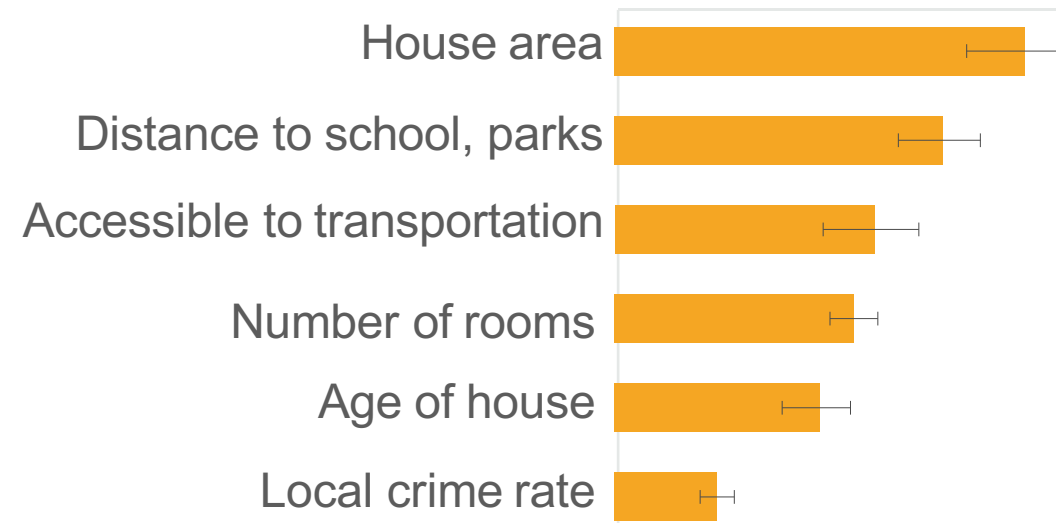
2. Feature-based explanation

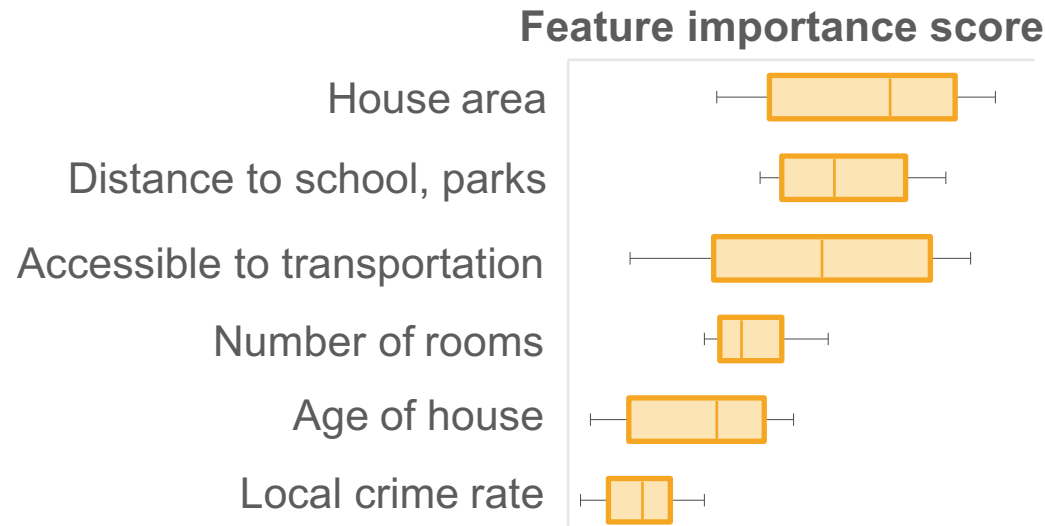
2.1 Feature Attribute
2.2 Feature Shape
2.3 Feature Interaction

How important is each feature to the result:

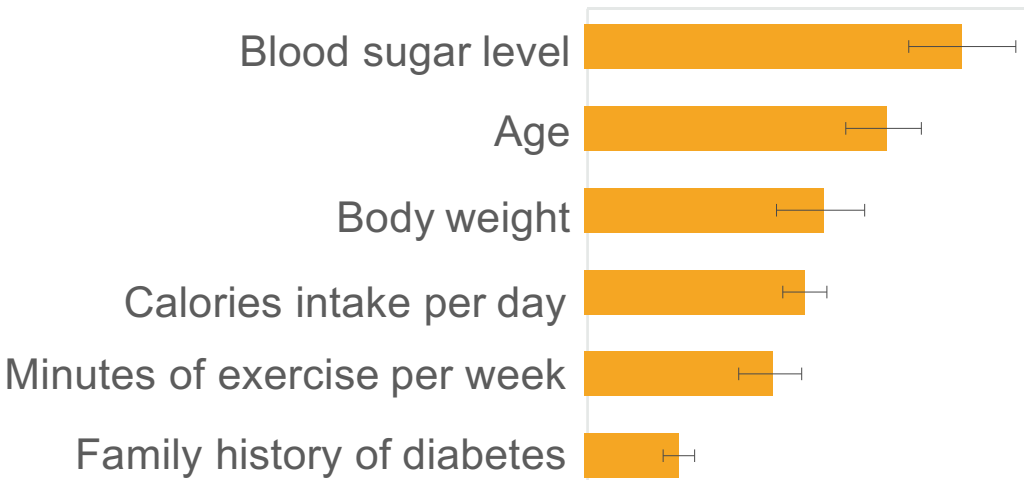


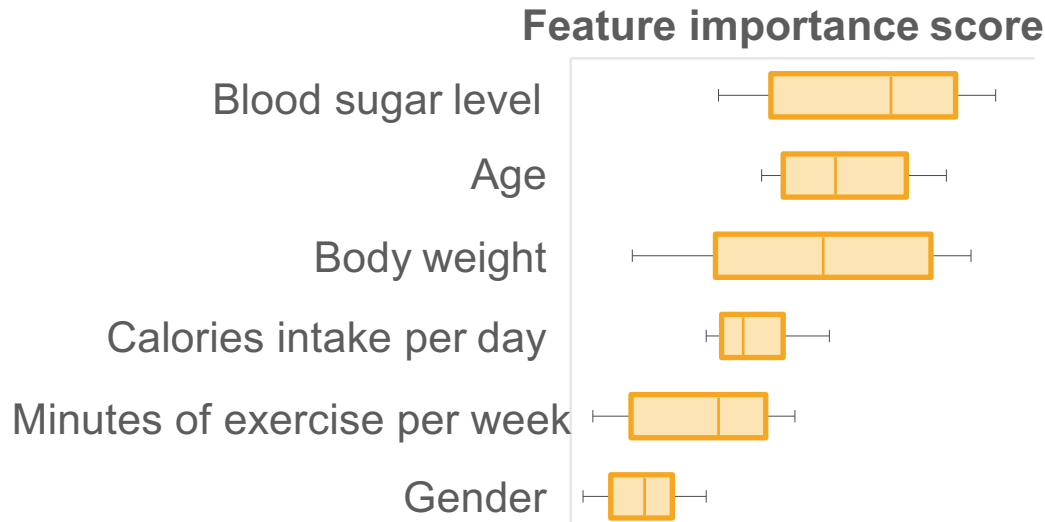
How important is each feature to the result:




Feature importance score
House area
Distance to school, parks
Accessible to transportation
Number of rooms
Age of house
Local crime rate

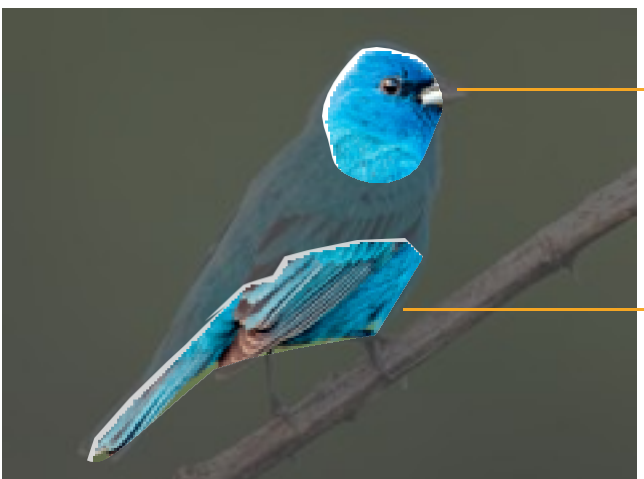
How important is each feature to the result:




Feature importance score
Blood sugar level
Age
Body weight
Calories intake per day
Minutes of exercise per week
Gender

Important regions (highlighted) for AI's bird recognization:

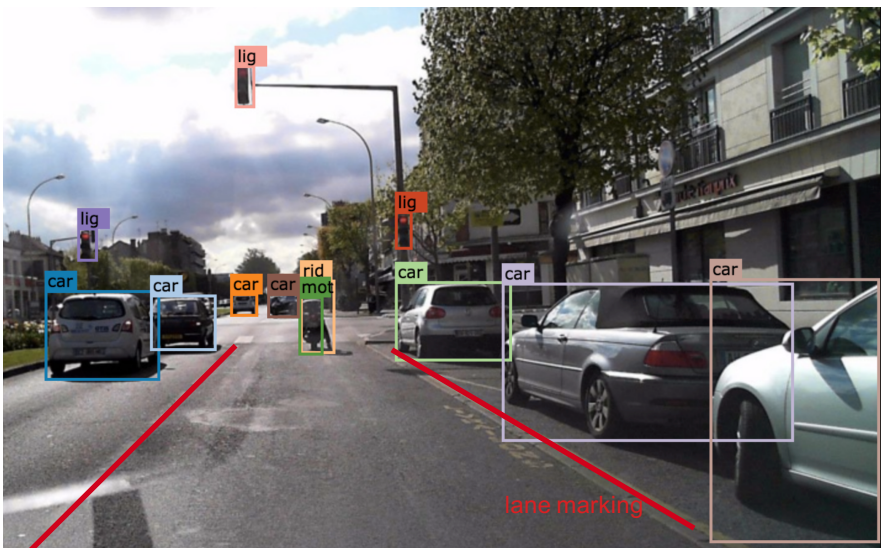
Important regions (highlighted) for AI's bird recognization:



contribute **30%** of the overall decision

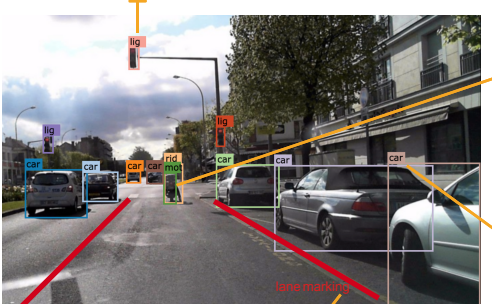
contribute **20%** of the overall decision

Important objects detected
for the self-driving car's judgement:



Important objects detected
for the self-driving car's judgement:

contribute **65%** of the **slow down & stop** decision



contribute **30%** of the **slow down & stop** decision

contribute **20%** of the **keep current lane** decision

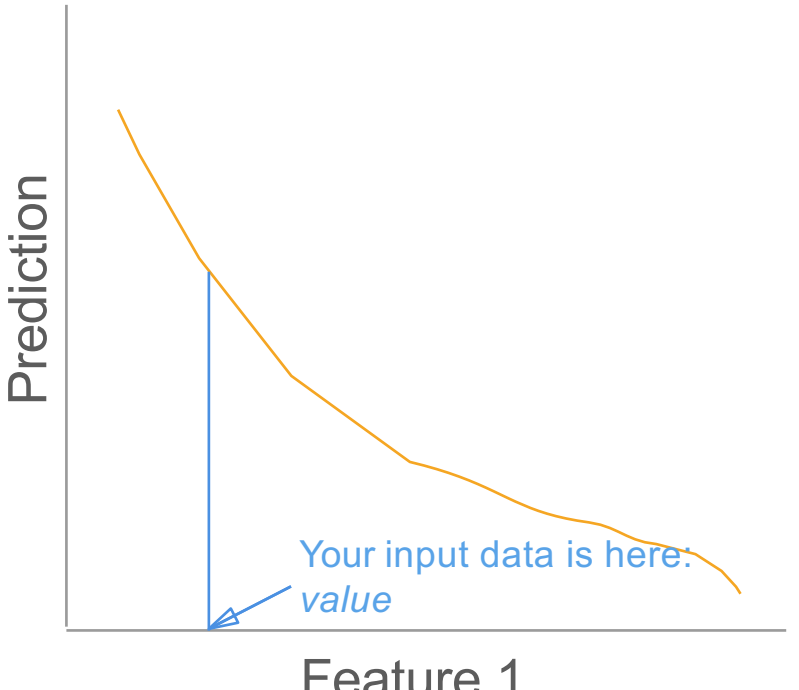
contribute **48%** of the **keep current lane** decision

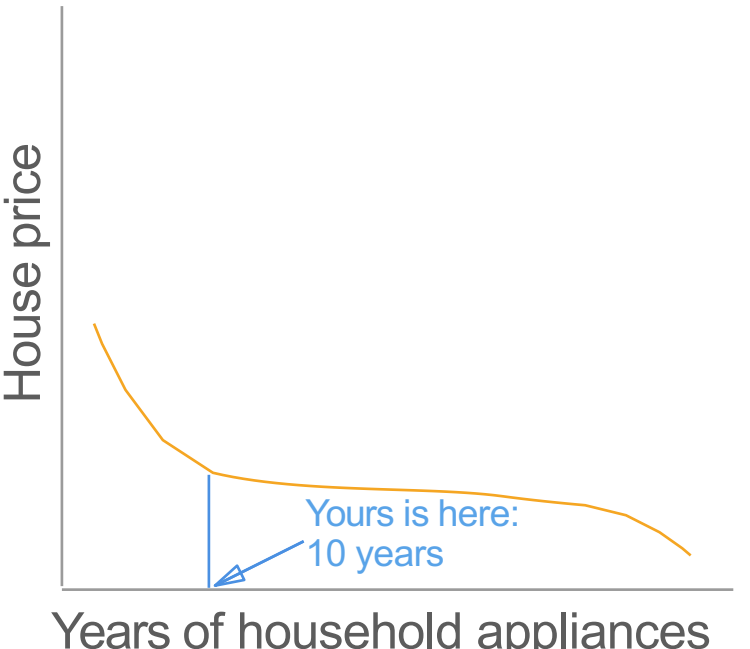
2. Feature-based explanation

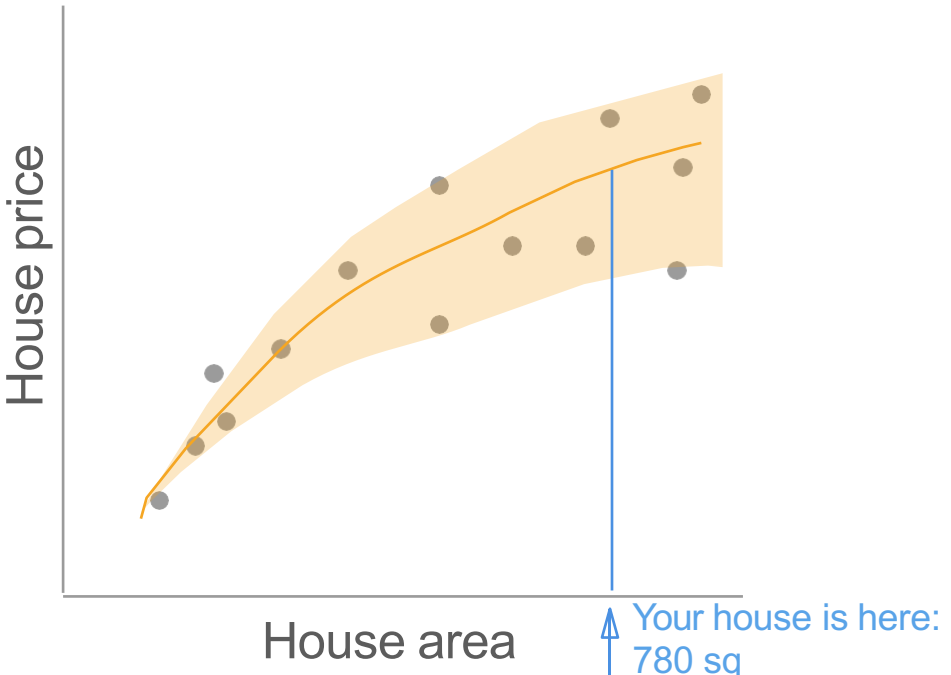
2.1 Feature Attribute

2.2 Feature Shape

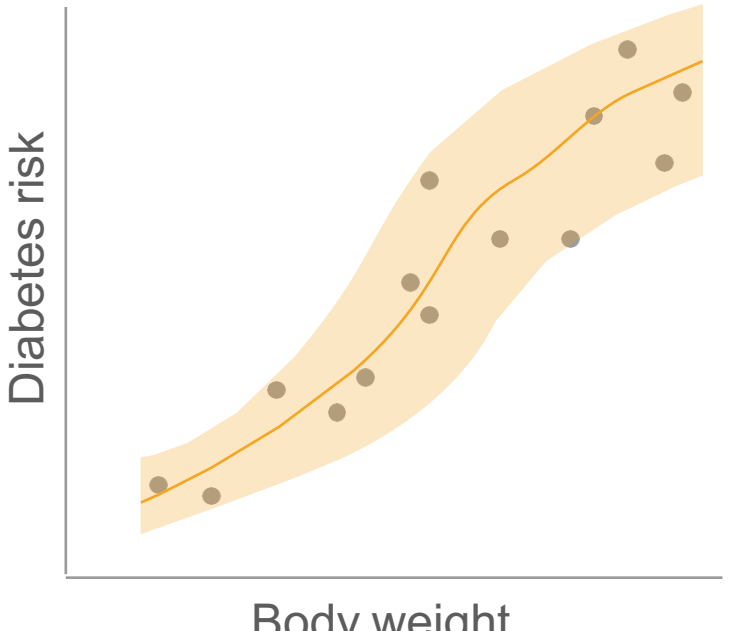
2.3 Feature Interaction


Prediction
Your input data is here:
value
Feature 1


House price
Yours is here:
10 years
Years of household appliances

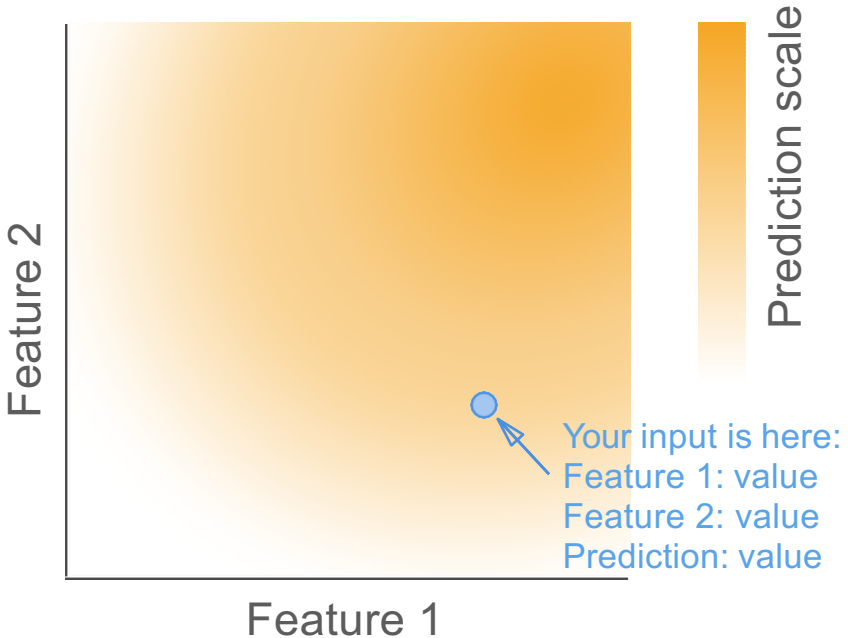

House price
House area
Your house is here:
780 sq

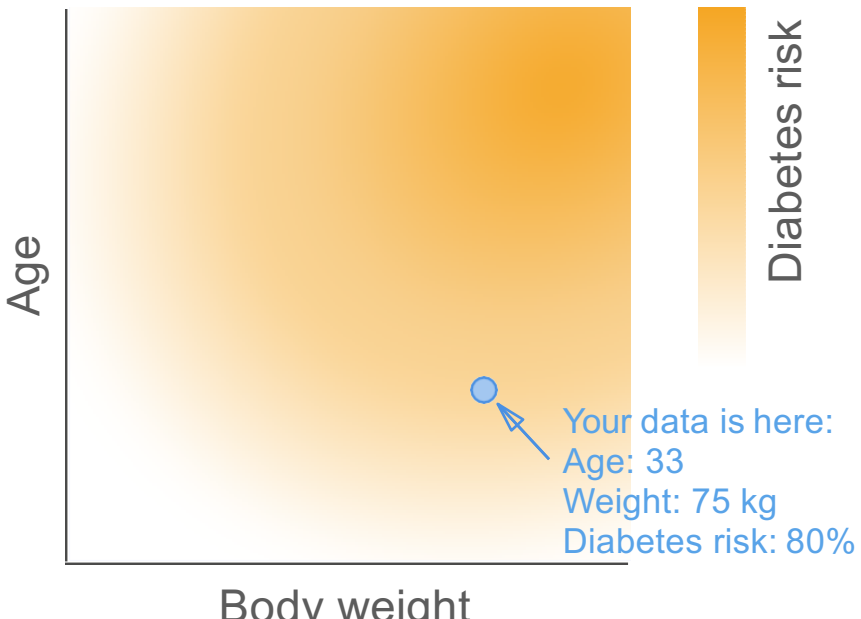

Diabetes risk
Your exercise data is here:
50 min/week
Minutes of exercise per week

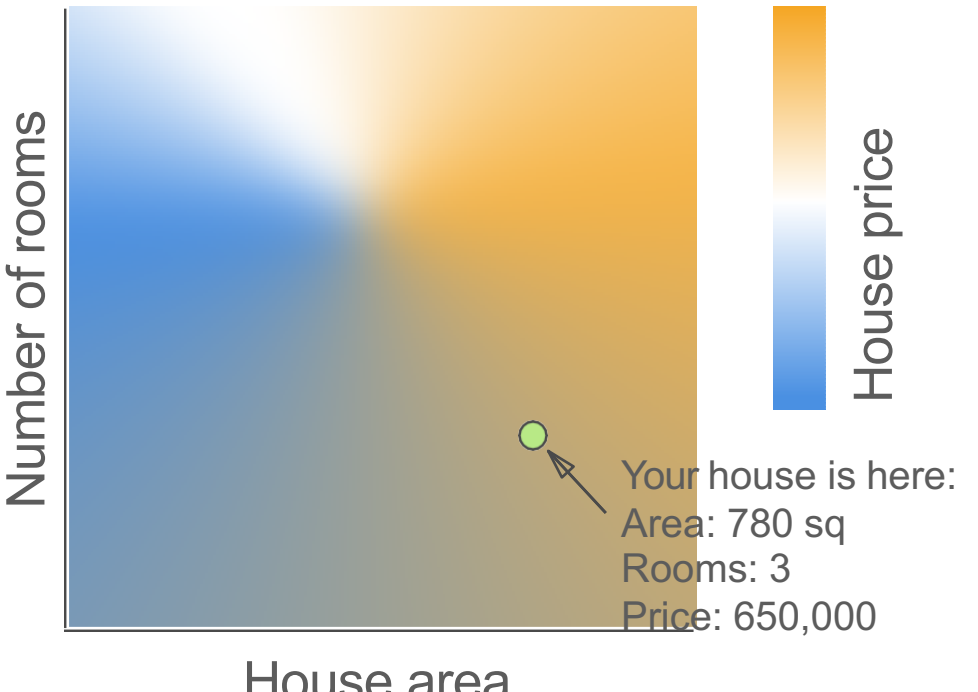

Diabetes risk
Body weight

2. Feature-based explanation

2.1 Feature Attribute
2.2 Feature Shape
2.3 Feature Interaction


Feature 2
Feature 1
Prediction scale
Your input is here:
Feature 1: value
Feature 2: value
Prediction: value


Age
Body weight
Diabetes risk
Your data is here:
Age: 33
Weight: 75 kg
Diabetes risk: 80%


Number of rooms
House area
House price
Your house is here:
Area: 780 sq
Rooms: 3
Price: 650,000

3. Example-based explanation

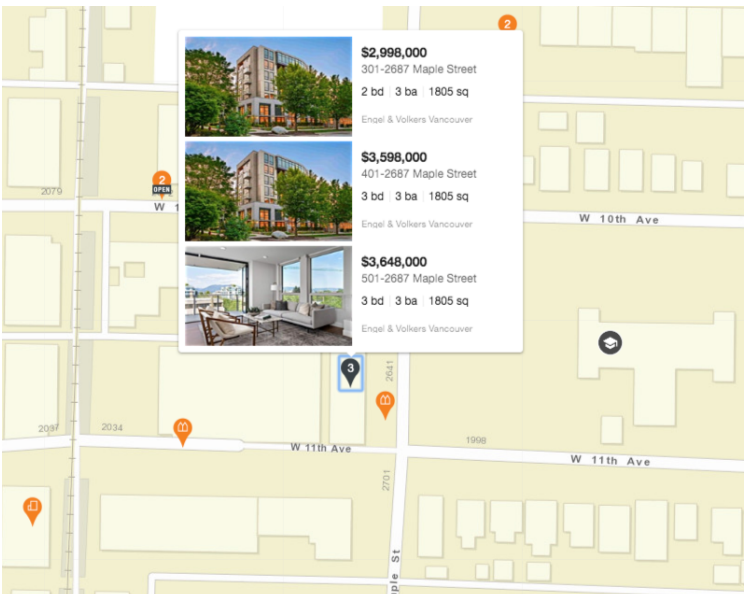
3.1 Similar Example
3.2 Typical Example
3.3 Counterfactual Example

A ***similar example*** as your input is like:

- Feature 1
- Feature 2
- Feature 3
- Feature 4
- Feature 5
- Feature 6

- **Prediction:**

The houses of **similar *features*** as yours



A **similar *case*** as yours is like:

- Male, 35 years old
- Three consecutive blood sugar level: normal, normal, higher than normal
- Body weight: 81 kg, height 183 cm
- Calories intake per day: 3400
- Minutes of exercise per week: 60 min
- Family history of diabetes: ……
- **Diabetes risk: 82%**

Similar images to the one you uploaded:

Indigo Bunting
95%

Indigo Bunting
95%

Blue Grosbeak
70%

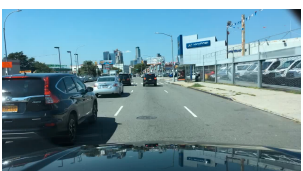
Blue Grosbeak
70%

Lazuli Bunting
55%

Painted Bunting
45%

Similar traffic conditions as the current one, from the dataset to train the self-driving car:





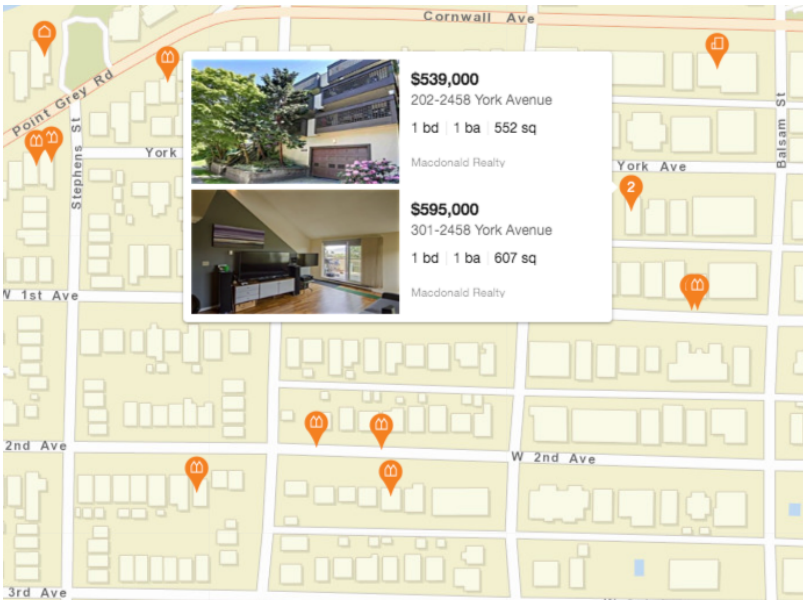

3. Example-based explanation

3.1 Similar Example
3.2 Typical Example
3.3 Counterfactual Example

A ***typical example*** of the same prediction as yours (prediction value) is like:

- Feature 1
- Feature 2
- Feature 3
- Feature 4
- Feature 5
- Feature 6

The houses of **similar *price*** as yours

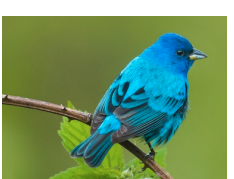


A **typical** case of the same diabetes risk as yours (80%) is like:

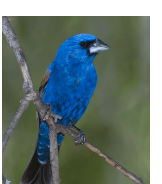
- Male, 45 years old
- Three consecutive blood sugar level: normal, normal, higher than normal
- Body weight: 78 kg, height 175 cm
- Calories intake per day: 3000
- Minutes of exercise per week: 30 min
- Family history of diabetes: ……
- .....

The three most likely bird according to your uploaded image, and **typical examples**

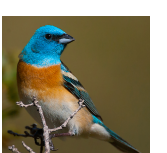
Indigo Bunting
95%



Blue Grosbeak
70%



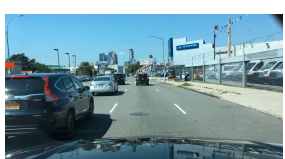
Lazuli Bunting
55%



Typical traffic conditions to reach the self-driving car's current decison:

Keep straight
95%

Keep current speed
70%



Right lane change
55%

3. Example-based explanation

3.1 Similar Example
3.2 Typical Example
3.3 Counterfactual Example

If one of your input features had changed to the following value, your predicted outcome would have increased by 20%:

- Feature 1 changed to some value
- Feature 2 changed to some value
- Feature 3 changed to some value
- Feature 4 changed to some value
- Feature 5 changed to some value
- Feature 6 changed to some value
- ……

If the feature of your house had changed to the following feature,
your house would have increased 10% of the estimated value

- have a back yard, or
- 3 bathrooms, or
- 1200 sq, or
- less than 10 years old, or
- has new household appliances
- ……

If your health data had changed to the following, your diabetes risk would have decreased by 20%:

- 3 years younger than now
- Body weight: loss 5 kg
- Increase 50 min of weekly exercise
- Reduce 500 calories of daily calories intake
- ……

Bird A highlight different regions Bird B

Bird A >> progressive transition >> Bird B

4. Rule-based explanation

4.1 Decision Rules
4.2 Decision Tree
4.3 Decision Flowchart

If **feature 1** ≤ some value,
and **feature 2** > some value,
Then the prediction **is some value**

If **house area** is some value,
and **distance to school, parks** < some value,
Then the prediction **is another value**

If **house area** ≤ 800 sq,
and **distance to school, parks** > 2.5 km,
Then house price **is no more than 600,000**

If **house area** is 800 - 900 sq,
and **distance to school, parks** < 2.5 km,
Then house price **is about 700,000-850,000**

If **blood sugar** is **high**,
and **body weight** is **overweight**,
Then the estimated diabetes risk
is above 80%

If **blood sugar** is **normal**,
and **body weight** is **overweight**,
Then the estimated diabetes risk
is about 20-50%

If **bird bill** is **small and thin**,
and **wings and tails** are **short**,
Then the bird is recognized as
Indigo Bunting

If **bird bill** is **big and thick**,
and **wings and tails** are **long**,
Then the bird is recognized as
Blue Grosbeaks

If **traffic sign** is **stop sign**,
or the speed of the **car in front** are **slower**,
Then the speed decision is to
slow down and stop

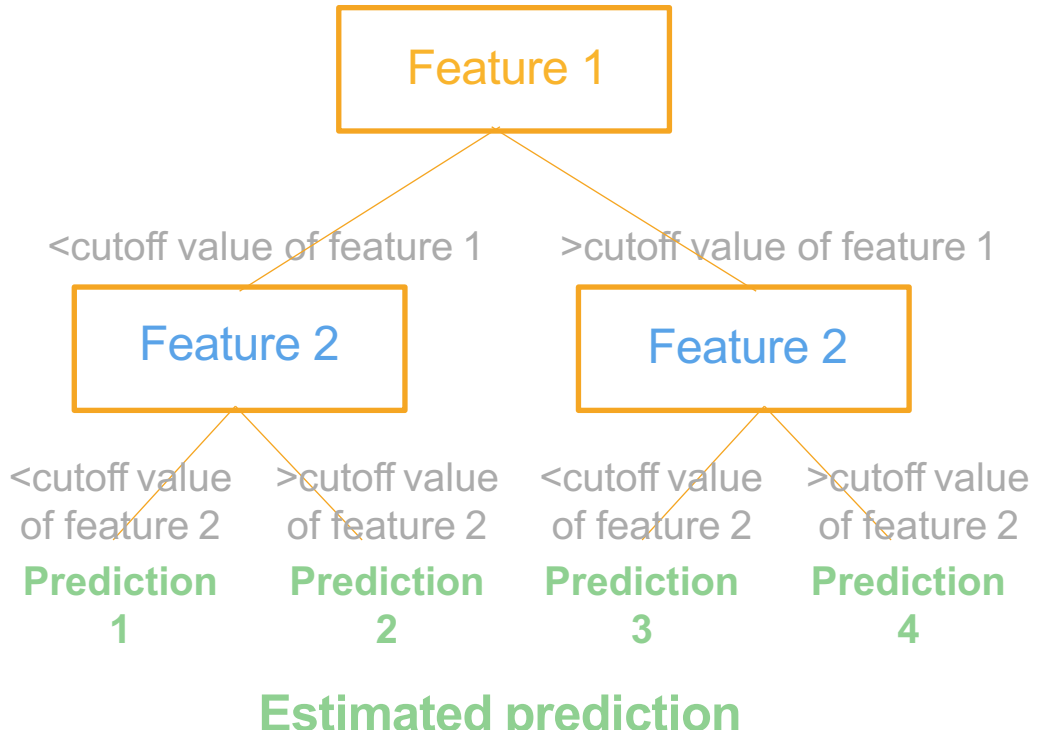
If **traffic sign** is **50km/h speed limit**,
and the speed of the **car in front** are the **same or faster**,
Then the speed is kept at
50km/h

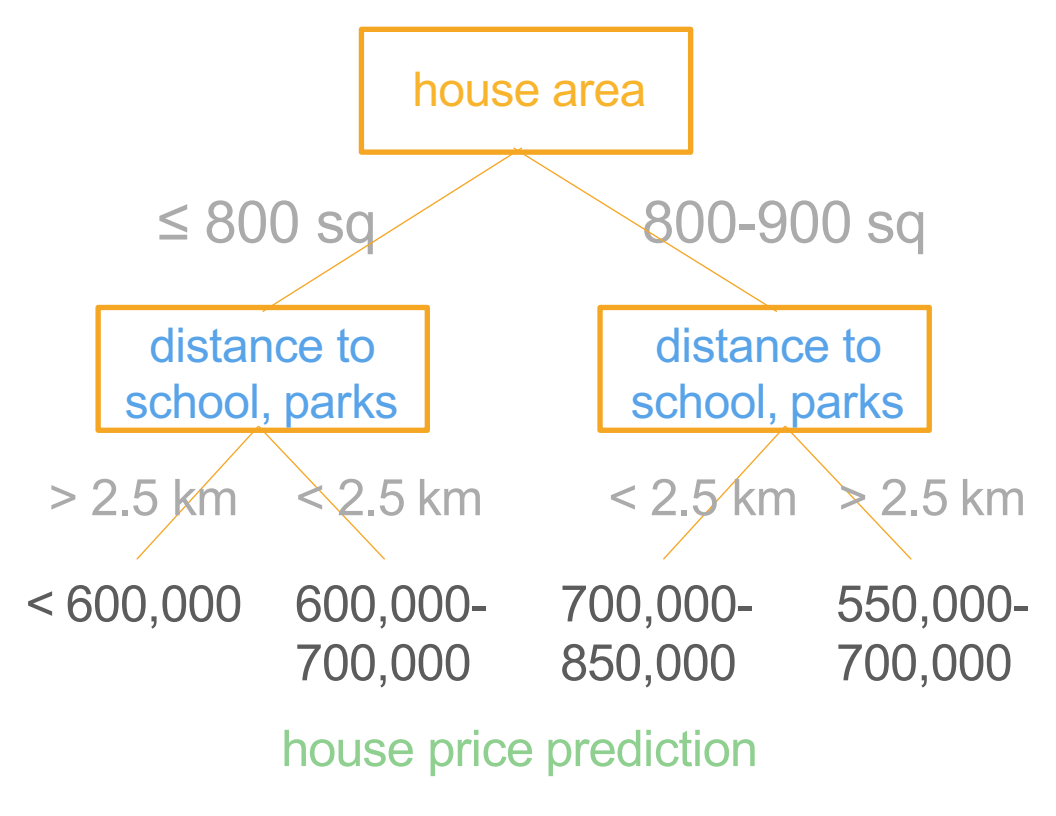
	house area	distance to school, parks	house price prediction
Rule 1	≤ 800 sq	> 2.5 km	< 600,000
Rule 2	≤ 800 sq	< 2.5 km	600,000-700,000
Rule 3	800-900 sq	< 2.5 km	700,000-850,000

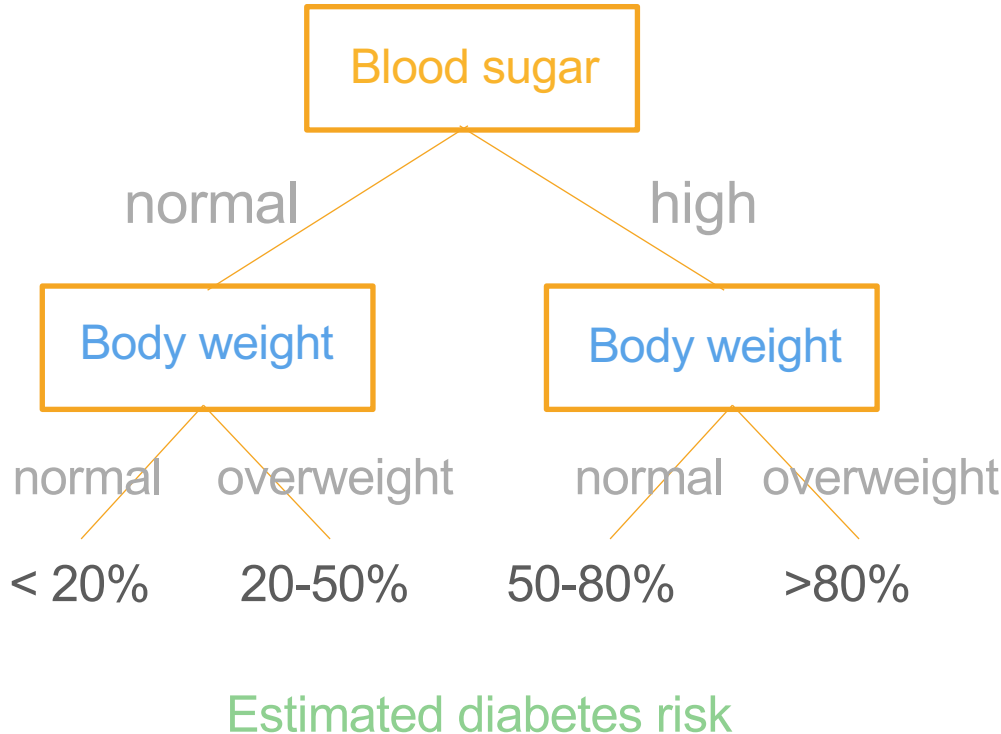
	blood sugar	body weight	diabetes risk
Rule 1	high	high	> 80%
Rule 2	high	normal	50-80%
Rule 3	normal	normal	< 20%

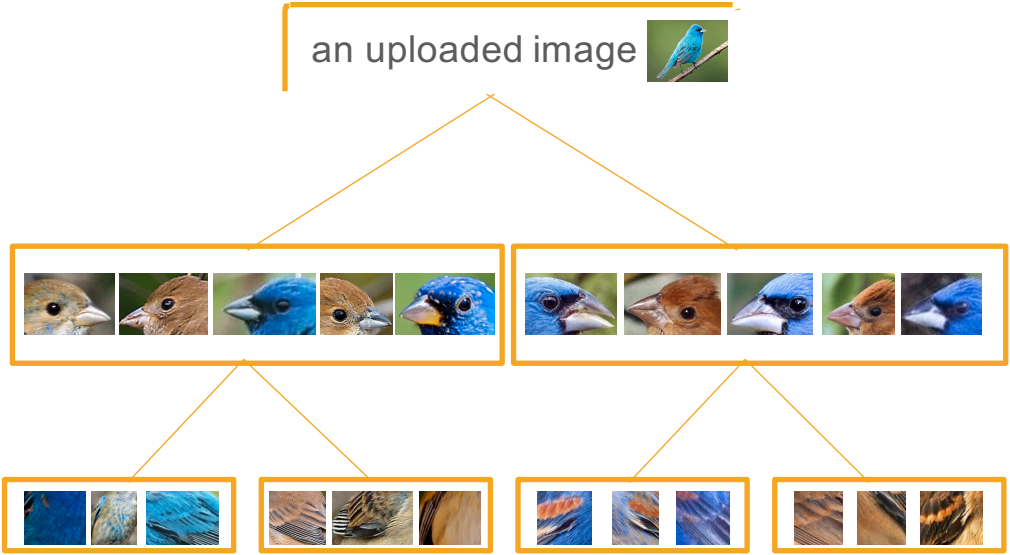
4. Rule-based explanation

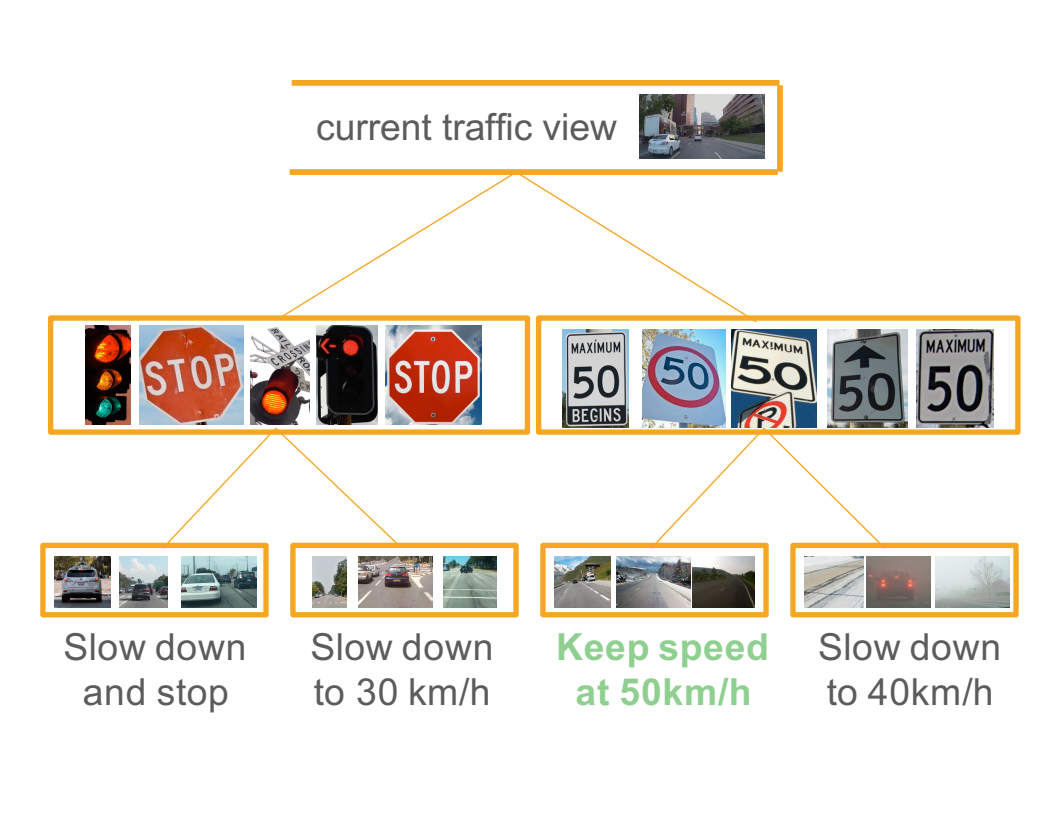
4.1 Decision Rules
4.2 Decision Tree
4.3 Decision Flowchart


Feature 1
<cutoff value of feature 1
>cutoff value of feature 1
Feature 2
Feature 2
<cutoff value of feature 2
>cutoff value of feature 2
<cutoff value of feature 2
>cutoff value of feature 2
Prediction 1
Prediction 2
Prediction 3
Prediction 4
Estimated prediction


house area
≤ 800 sq
800-900 sq
distance to school, parks
distance to school, parks
> 2.5 km
< 2.5 km
< 2.5 km
> 2.5 km
< 600,000
600,000-700,000
700,000-850,000
550,000-700,000
house price prediction

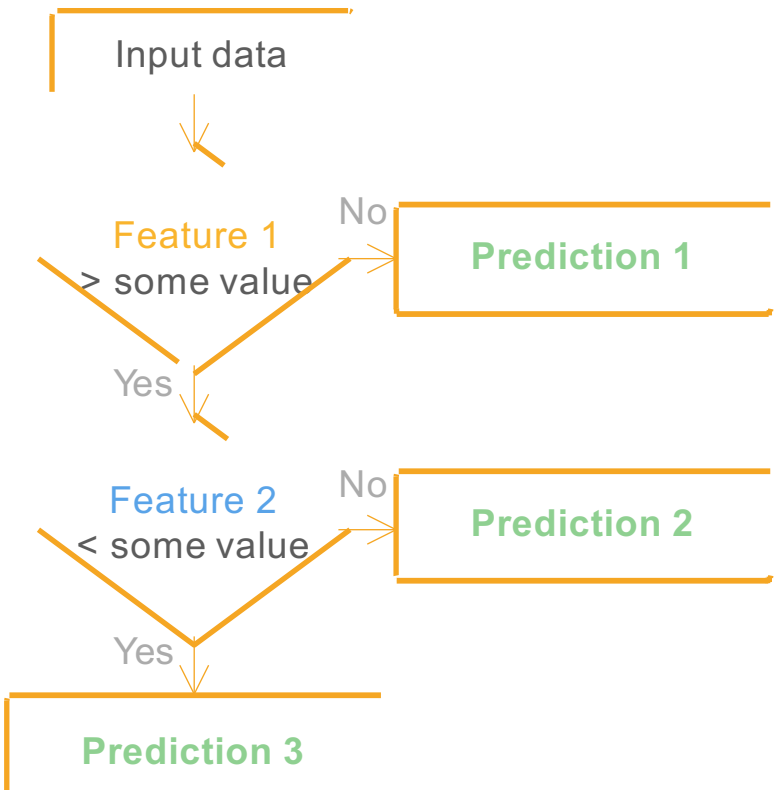

Blood sugar
normal
high
Body weight
Body weight
normal
overweight
normal
overweight
< 20%
20-50%
50-80%
>80%
Estimated diabetes risk

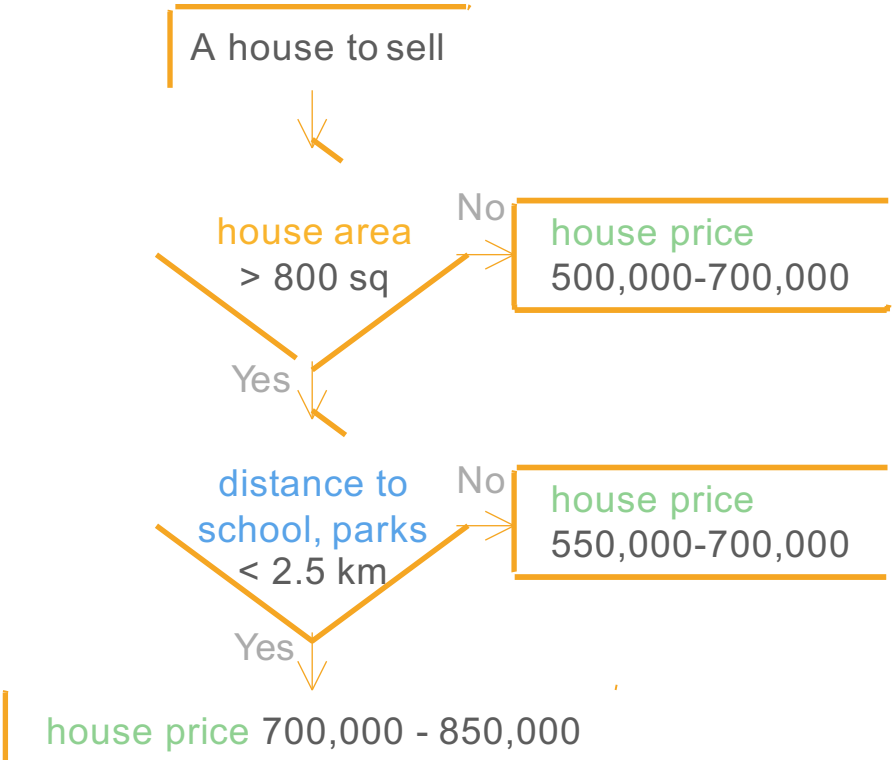

an uploaded image
Indigo Bunting, male
Indigo Bunting, female
Blue Grosbeak, male
Blue Grosbeak, female

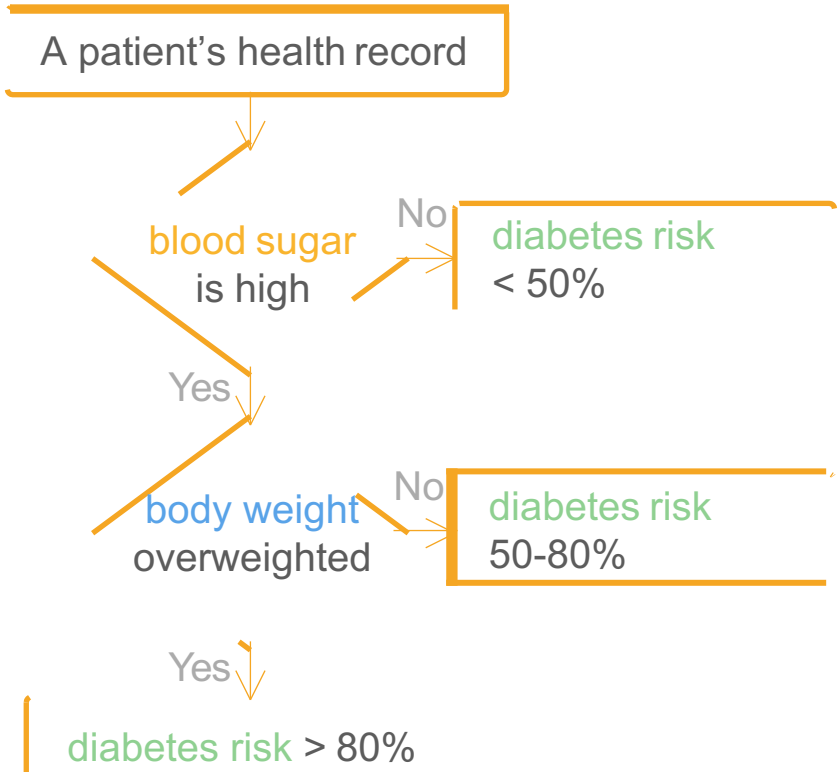

current traffic view
STOP
STOP
MAXIMUM
50
BEGINS
50
MAXIMUM
50
50
MAXIMUM
50
Slow down and stop
Slow down to 30 km/h
Keep speed at 50km/h
Slow down to 40km/h

4. Rule-based explanation

4.1 Decision Rules
4.2 Decision Tree
4.3 Decision Flowchart


Input data
Feature 1
> some value
No
Prediction 1
Yes
Feature 2
< some value
No
Prediction 2
Yes
Prediction 3


A house to sell
house area
> 800 sq
No
house price
500,000-700,000
Yes
distance to
school, parks
< 2.5 km
No
house price
550,000-700,000
Yes
house price 700,000 - 850,000


A patient's health record
blood sugar
is high
No
diabetes risk
< 50%
Yes
body weight
overweighted
No
diabetes risk
50-80%
Yes
diabetes risk > 80%

an uploaded image 

looks at head

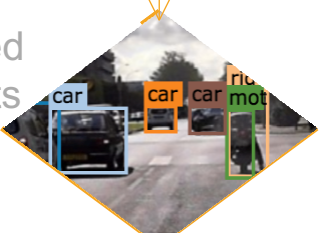
looks at belly

reach a conclusion on the bird species

current traffic view

detected traffic sign

detected traffic objects



reach driving decisions