Interview

Overview

Introduction to SuRE
Demonstrate an interactive visual analytics tool for model understanding.

Model Exploration
Use SuRE to analyze and understand the behavior of a given ML model.

Interview
Collect feedback about SuRE and discuss long-term collaboration.

Introduction to SuRE

What Is SuRE?

An interactive visualization tool to explore model behavior.

It uses **if-then rules** to identify and describe data subgroups where the model behaves consistently (most/all predictions are the same).

IF Glucose < 136 **AND** Insulin < 115 **AND** Age < 37.3 **THEN** non-diabetic

For example, the rule above means:

For a group of people (instances) that has Glucose<136, and Insulin < 115, and Age < 37.3, this model consistently make a prediction of non-diabetic.

How Does SuRE Work?

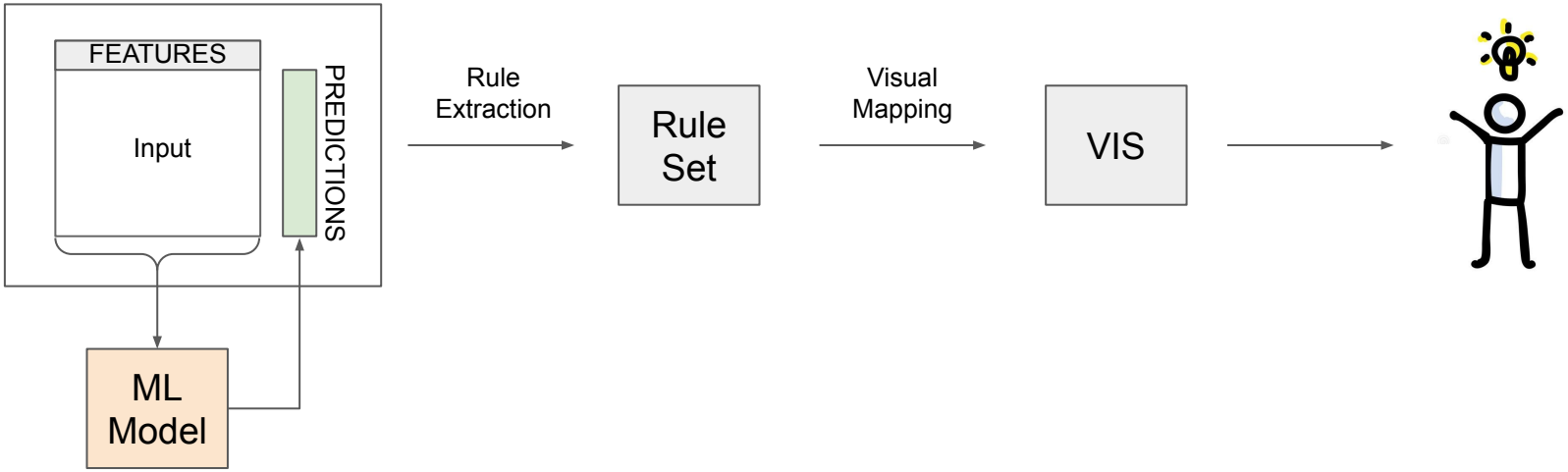
To explain how SuRE works we are going to use an example of diabetes diagnosis.

Imagine that a classification model is trained to suggest whether a person has diabetes or not. You do not need to know how such model is trained. You can just think it as a black box.

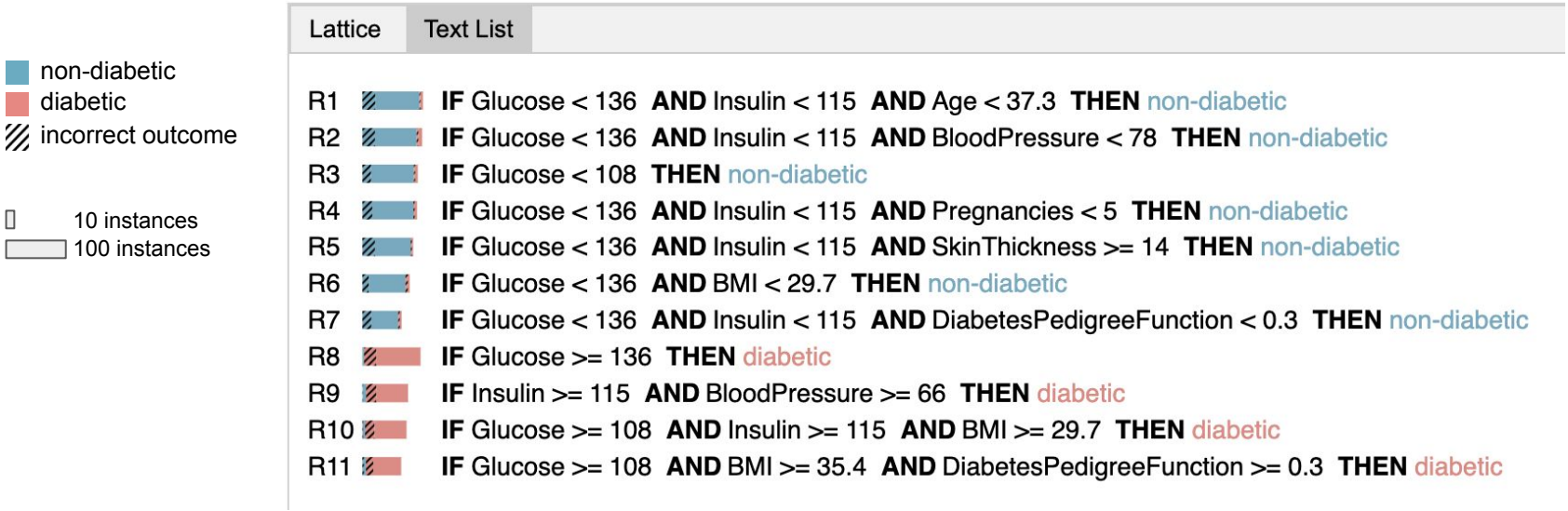
Given the lab test result of a person, this model suggests whether this person is diabetic or non-diabetic.

We use a if-then rules to describe how the model make suggestions on a group of people.

Workflow of SuRE



What Is A Rule Set?



Here is an example of a set of 11 rules that describe how the model behaves on the training data set.

Challenge 1: Influence of One Or More Predicate(s)

Given the rule (behavior description) below, we still have some questions.

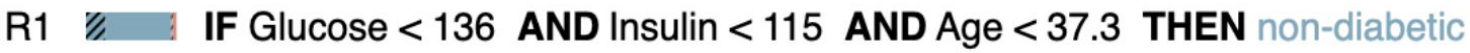
R1  **IF** Glucose < 136 **AND** Insulin < 115 **AND** Age < 37.3 **THEN** non-diabetic

Q: Can the model make consistent prediction on subgroup that is described by only one predicate (condition), or two predicates?

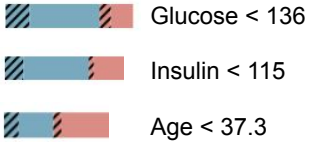
Q: With Glucose < 136 only, does the model make consistent prediction already?

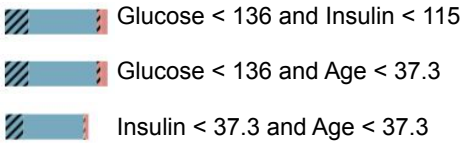
Q: How about the combination of Glucose and Insulin?

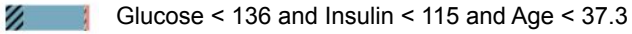
Challenge 1: Influence of One Or More Predicate(s)



A potential solution: Display <u>all the possible combinations</u> of the three conditions...

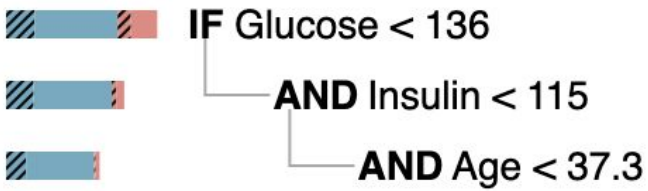




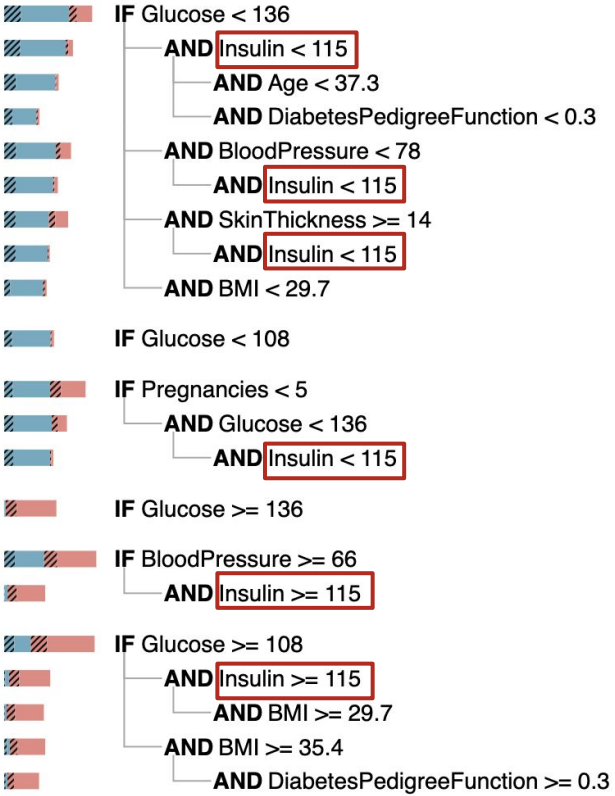


For a rule with n predicates, we need to check 2^n-1 combinations.

SuRE selects and displays the information of predicates (conditions) that are considered by the rule generation algorithm. That is, the predicate combinations that tends to describe a subgroup where a model makes consistent prediction. For example,



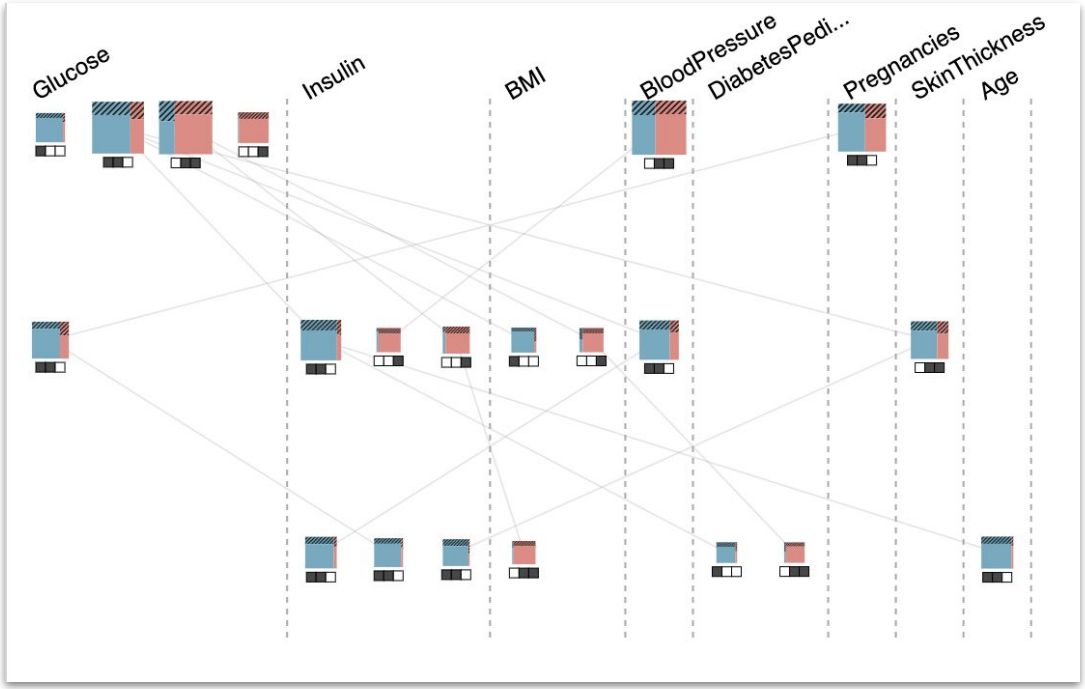
Challenge 2: Focus on A Feature of Interest



Now we can see the influence of one or more predicates, what if I only care about *blood pressure*?

For example, you really want to know how the value of *Insulin* is combined with other feature values to describe the model behavior.

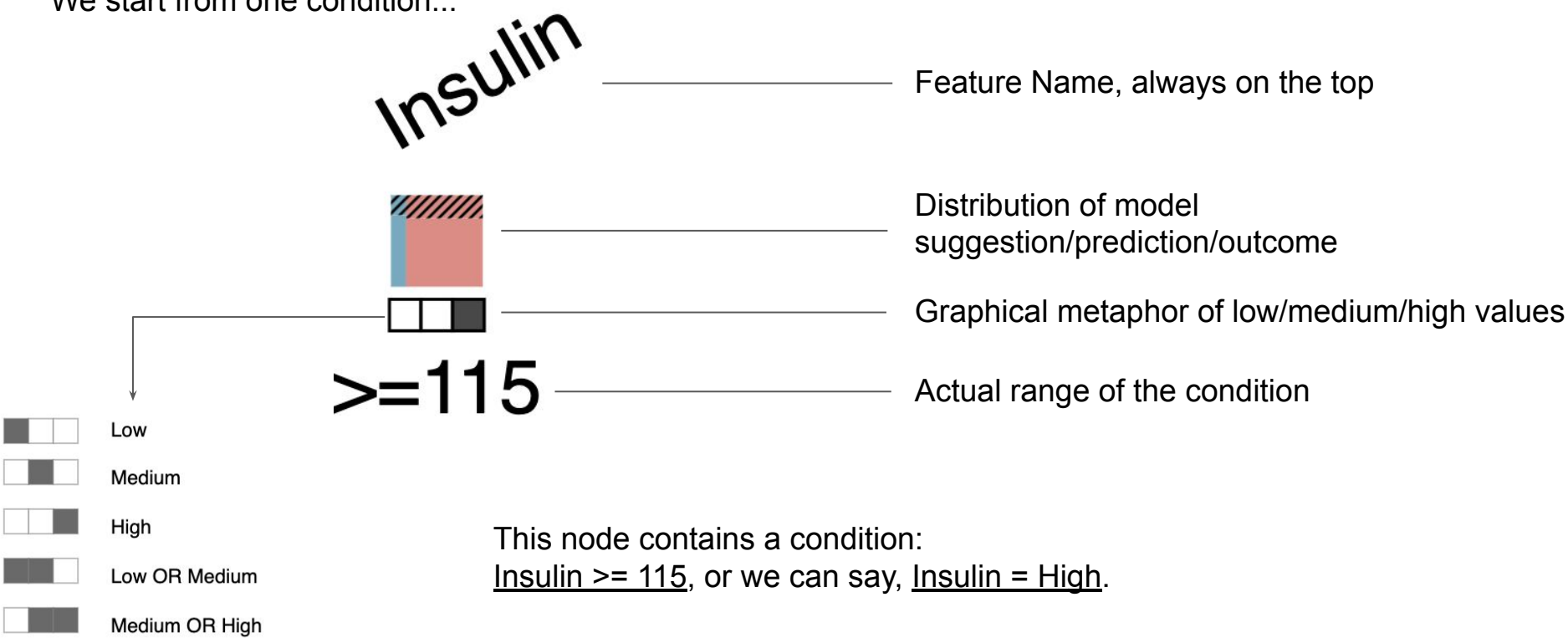
Challenge 2: Focus on A Feature of Interest



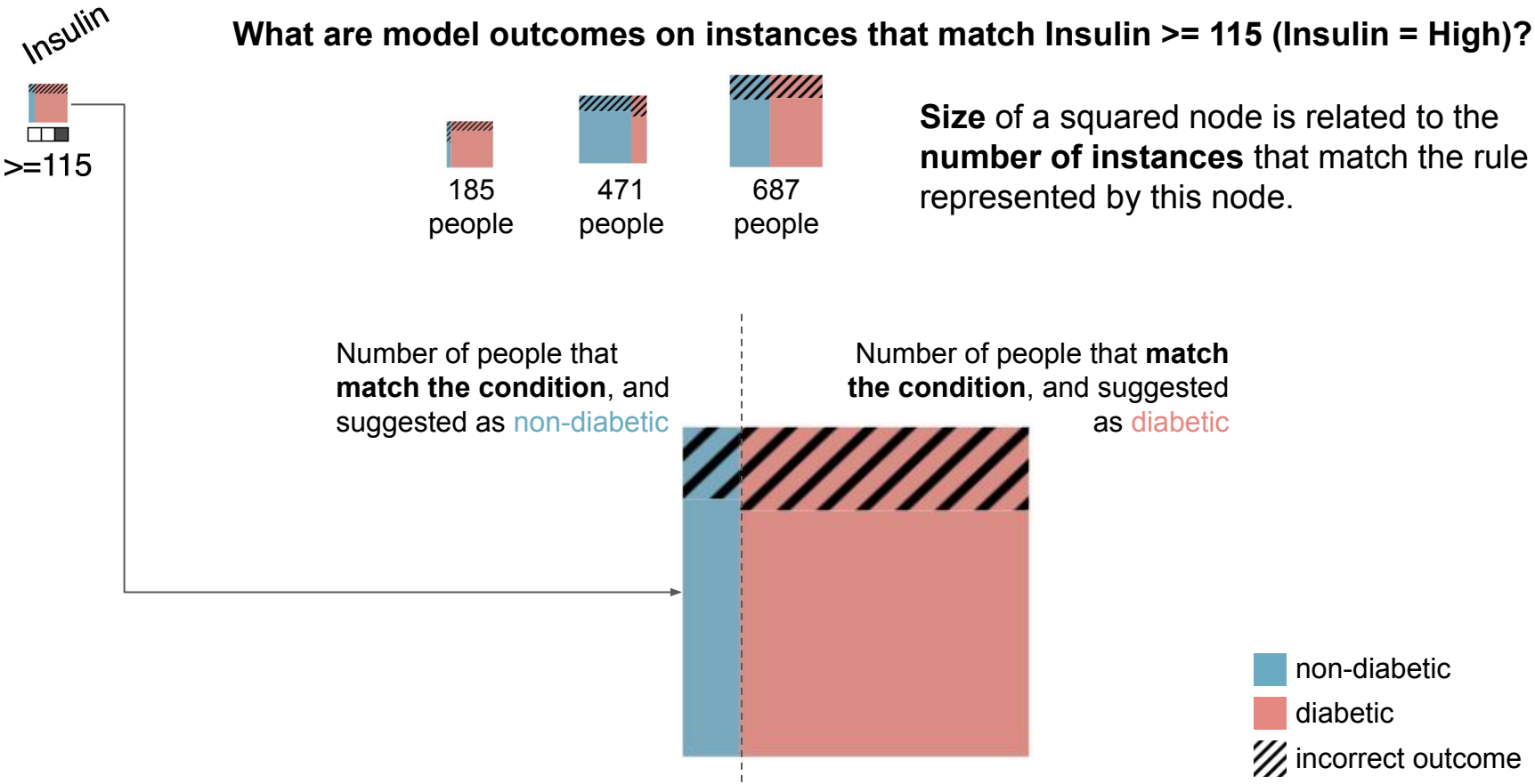
In SuRE, we propose a feature-aligned tree visualization of rule logic that integrates the ***alignment of features*** and ***hierarchical structure*** so that users can easily locate rules that contain a feature of interest and check influence of one or more predicates.

How to Read A Rule?

We start from one condition...

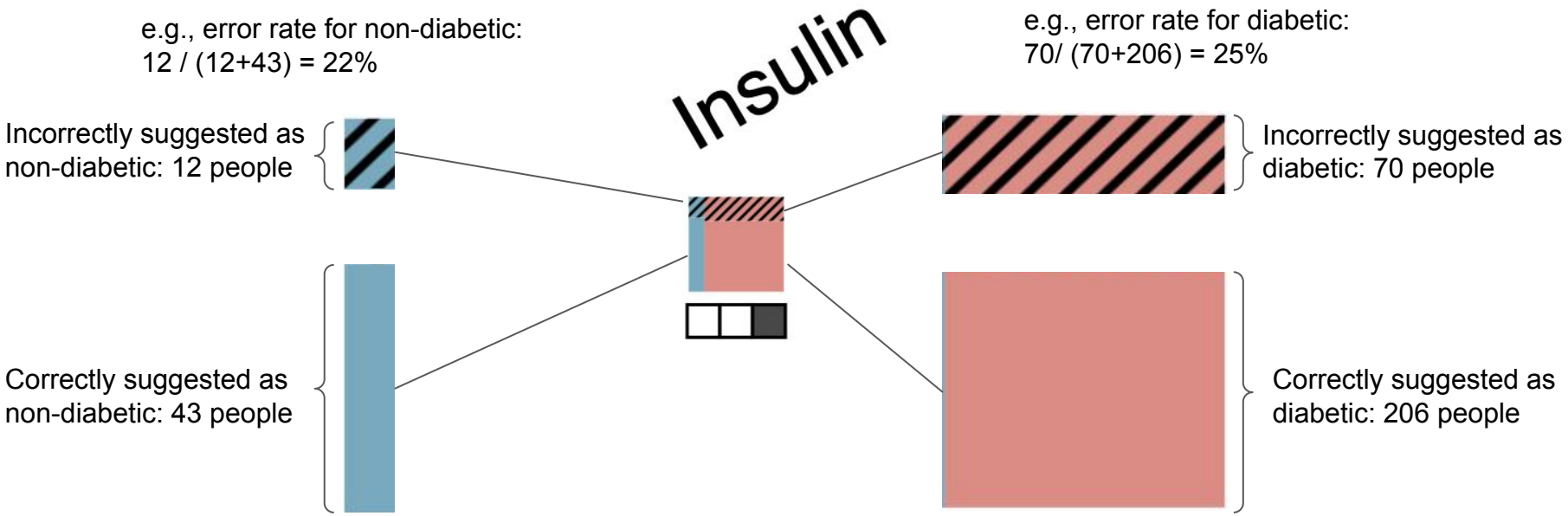


This node contains a condition:
Insulin >= 115, or we can say, Insulin = High.


Insulin
>=115
What are model outcomes on instances that match Insulin >= 115 (Insulin = High)?
185 people
471 people
687 people
Size of a squared node is related to the number of instances that match the rule represented by this node.
Number of people that match the condition, and suggested as non-diabetic
Number of people that match the condition, and suggested as diabetic
non-diabetic
diabetic
incorrect outcome
Because this condition covers more diabetic suggestions from the model, we can describe the model's behavior as:
If Insulin >= 115 (or we say Insulin = High), then suggest diabetic

The size of the colored rectangle represents the number of different model suggestions for the group of people with the lab test results that match the condition.

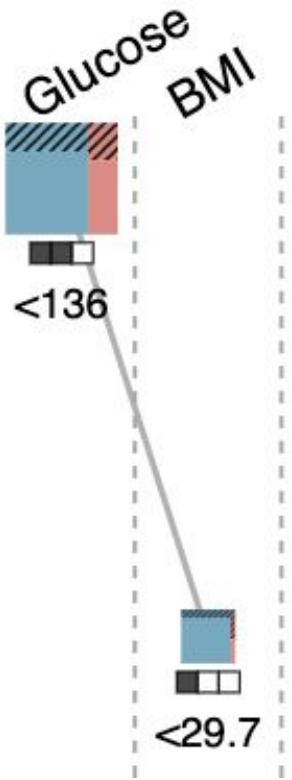
The larger the bar, the more people are given the suggestion of the corresponding colors.



How to Read a Rule / Decision Path?

Node 1:
IF Glucose=Low OR Medium
(THEN non-diabetic**)**

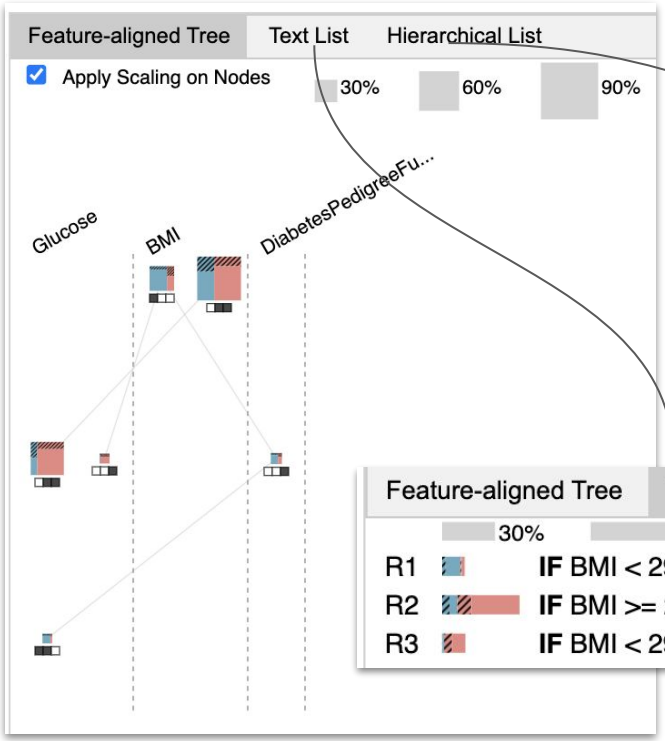
Node 2:
IF Glucose=Low OR Medium
AND BMI=Low
(THEN non-diabetic**)**

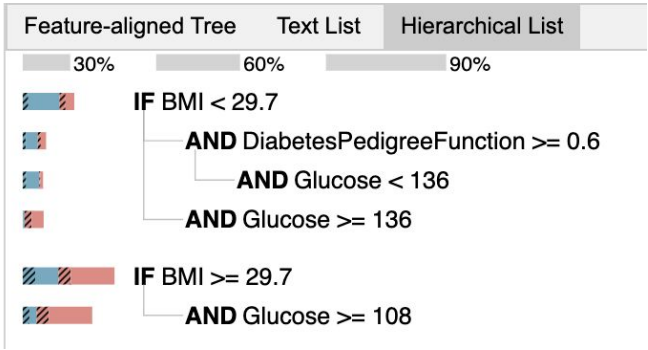


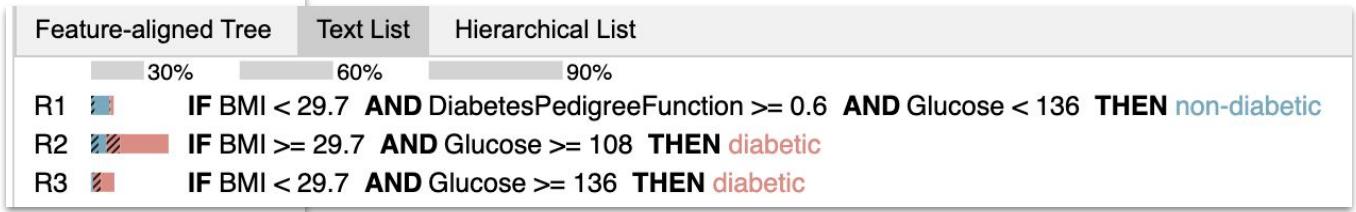
1) A node at the 1st layer (e.g., node 1) represents the first condition in a rule; a node at the 2nd layer (e.g., node 2) represents the **combination** of the first 2 conditions.

2) Always read the rule **from the top to the bottom!**

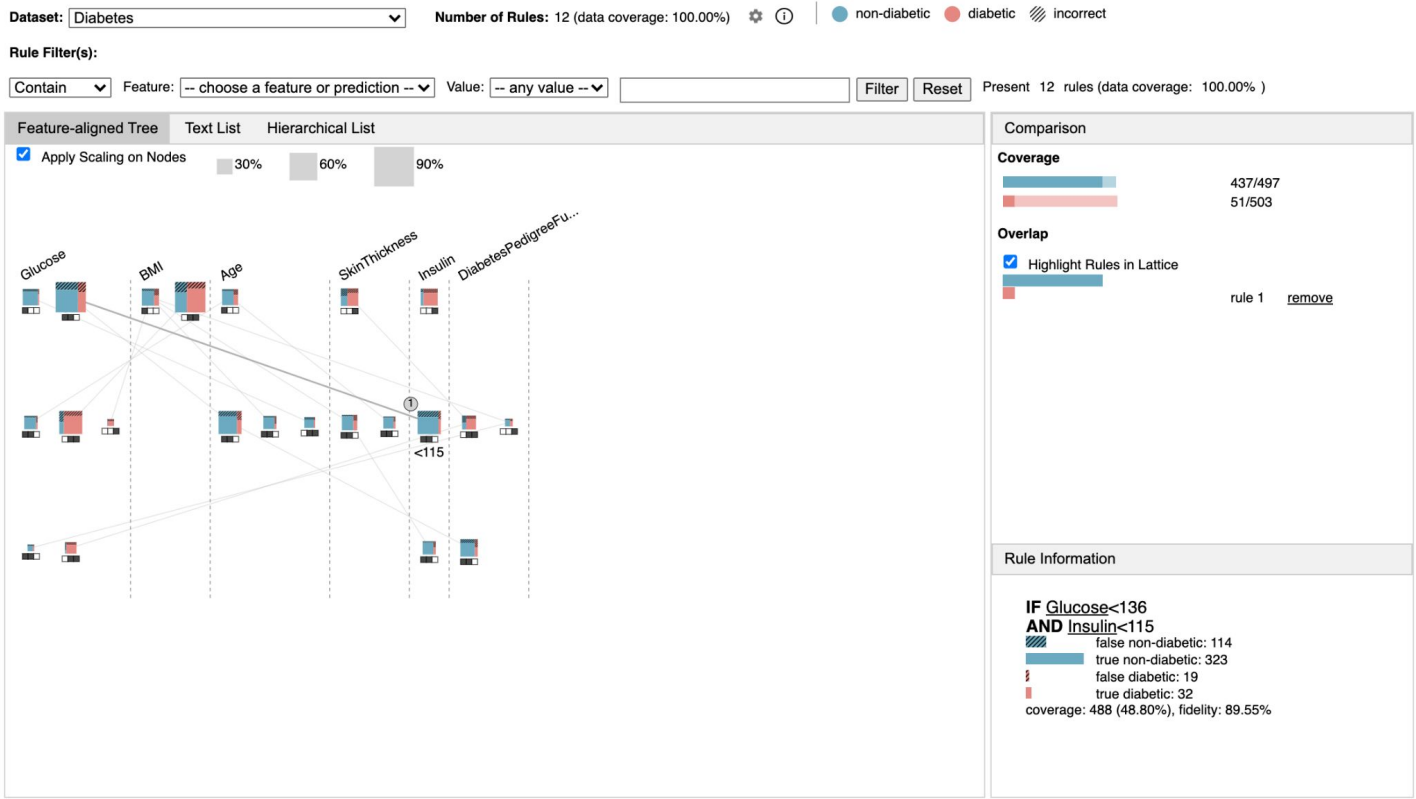
How to Read a Rule Set?



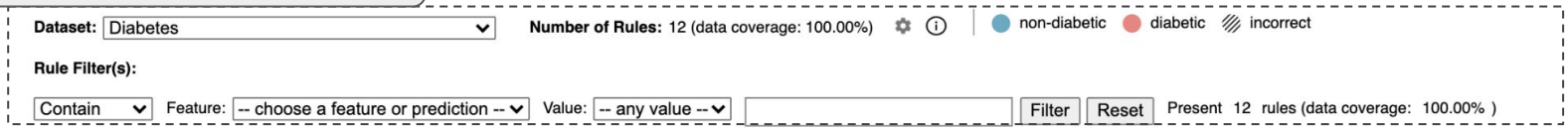


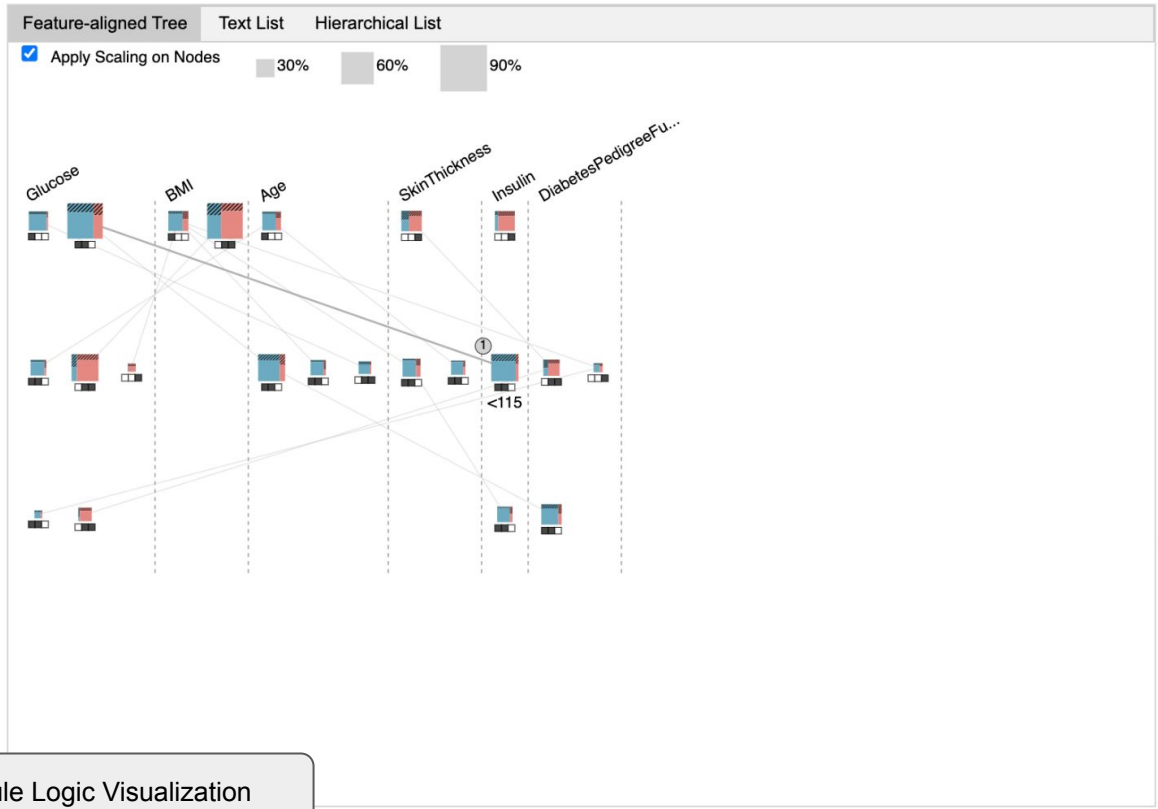


SuRE: User Interface



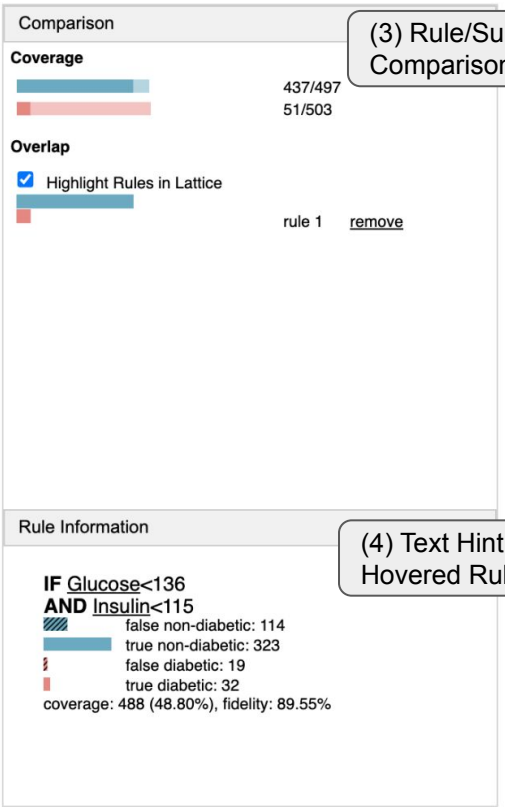
(1) Control Panel:
Filters, Rule Generation, Rule Set Info





(2) Rule Logic Visualization

(3) Rule/Subgroup Comparison



(4) Text Hint for Hovered Rule

Rule Generation Parameters

- Min Support: the minimal number of instances in one subgroup
- Min Fidelity: the minimal fidelity a rule should have (fidelity: accuracy of the rule)
- Max Number of Features (in each rule)
- Number of Feature Bins: related to the number of squares of the value metaphor. (3 bins: low, medium, high)

If you want to generate rules with fewer conditions, change max_num_feature;
If you want to check fewer rules, you can try to lower the min_fidelity, or increase min_support;
If you want to increase the data set coverage, try to lower the min_fidelity, increase max_num_feature may help.

Interaction & Demo

- Rule generation (para. explanation)
- Rule filter
- Rule comparison

Validation

- Some questions for readability
- Some question for lookup
- Now you can explore SuRE (http://nyuvis-web.poly.edu/projects/isure/) freely and ask any questions related to SuRE. We just want to make sure you know how to use SuRE before we move on to the next step.

Model Exploration with SuRE

Task

In this step, we are going to ask you to explore a pre-trained model for a loan application dataset (http://nyuvis-web.poly.edu/projects/isure/?d=loan) and to make a summary report of how this model behaves.

This model is trained to predict whether a loan applicant will default in the future.

You will use SuRE to generate rules and interact with them.

Please think aloud during the model exploration. That is, please tell us *what you are thinking as you explore the model and generate insights*. Besides, if you find *any problems* or you have *any questions that you cannot answer*, please let us know. This is really helpful for our research!

Interview: Feedback Collection

SuRE related questions

- What do you think are the most useful and interesting aspects of SuRE?
- How would you use SuRE in your own work? What kind of problems would you try to use it for? Do you have any specific project you would like to use it for? If yes, can you describe how you would use it in that context?
- What do you think are major limitations of SuRE or potential improvements that would make it more useful for you?
- Is there anything else you would like to share with us regarding SuRE?