Describethe glass

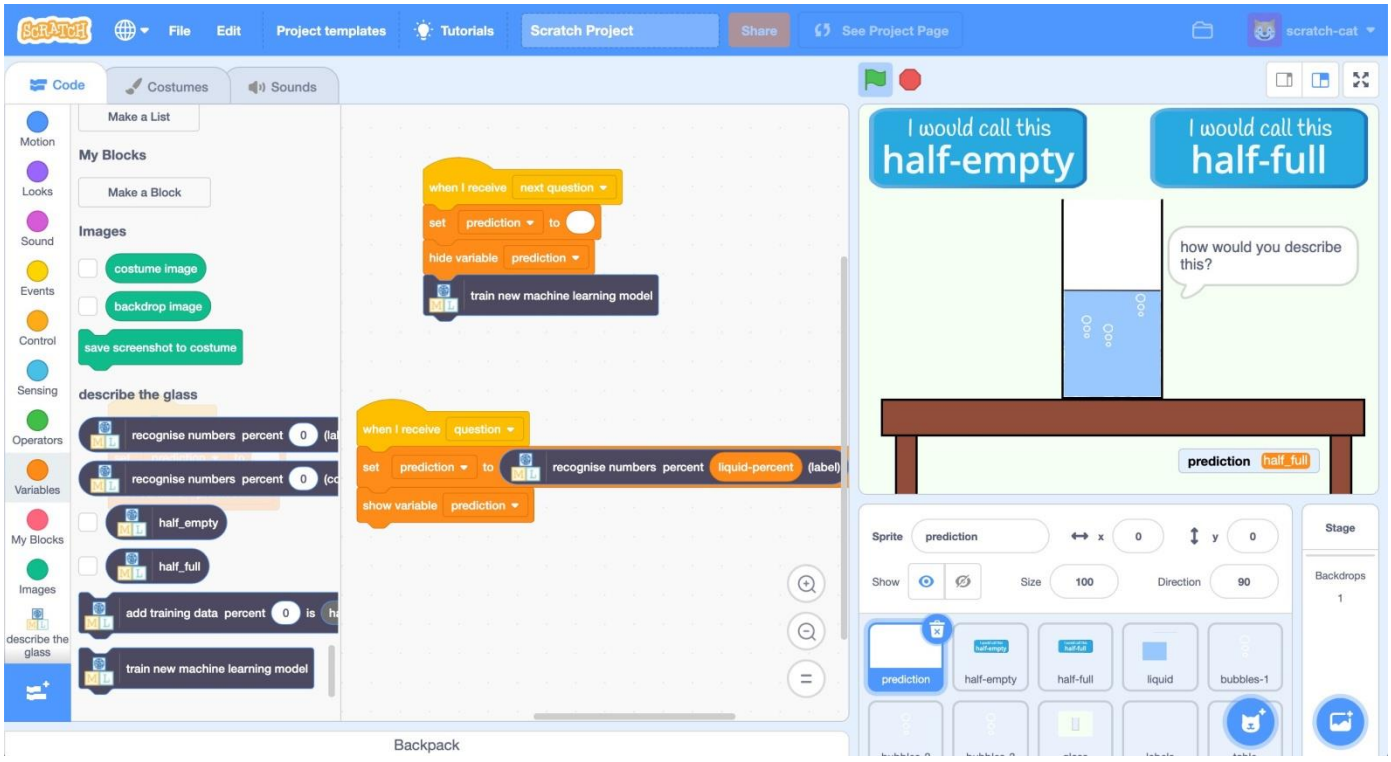
"Istheglasshalfemptyorhalffull?"

Wikipediadescribesthisquestionasademonstrationthata"situation may be seen in different ways depending on one's point of view", and as a test to "determine an individual's worldview".

Apessimisticpersonmightdescribeaglassashalf-empty.
Anoptimisticpersonmightdescribethesameglassashalf-full.

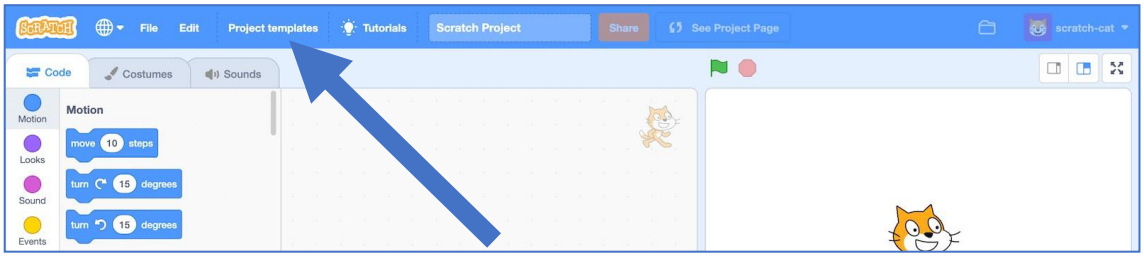
Inthisproject,you'regoingtoteachacomputerhowyouanswerthis question. And then you'll see what it has learned from you.

TheideaforthisprojectcamefromStanislavGerasimovich.Youcanseehisversionofitathttps://sta-ger.bitbucket.io/apps/beer



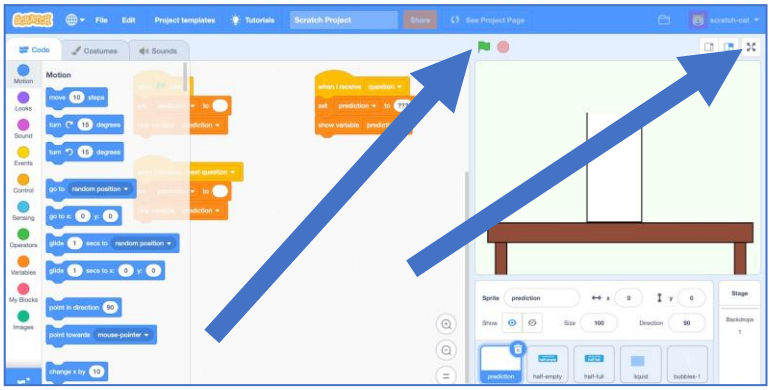
1. Gotohttps://machinelearningforkids.co.uk/scratch

2. Clickon“**Projecttemplates**”



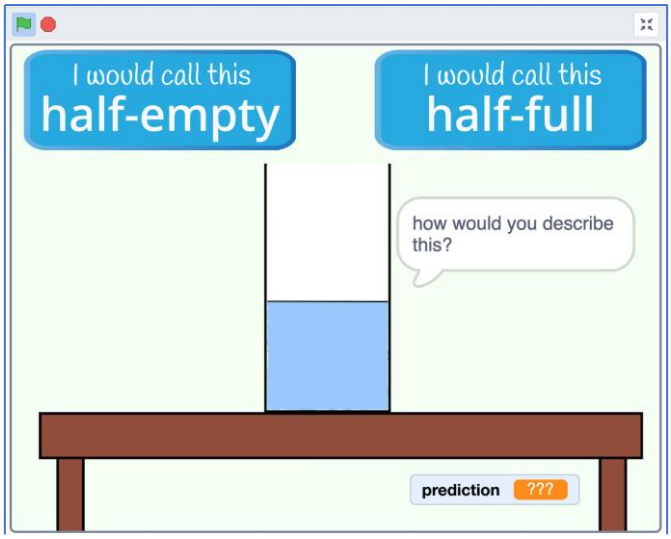
3. Clickonthe“**Describetheglass**”template

4. Clickonthe**full-screen**button,thentheGreenFlag



5. Usethebuttonsatthetoptoanswerafewquestions

Afterexplainingtheidea,theScratchprojectwillshowyouaglasswitha randomamountofliquidandaskyoutoclickthebuttonyouthink describes it.



Whathaveyoudonesofar?

Youbasedyourdescriptionoftheglassonhowmuchliquidtherewas.

Atthebottomofthescreen,youcanseethespacewherethecomputeris goingtodisplayapredictionofwhatyouthink.Inthisproject,youare goingtoupdatetheScratchcodesothatitcangeneratethisprediction.

Youcoulddothisbywritingarulethatthecomputercouldfollow.

But,forthisproject,you'regoingtotrainthecomputersothatitlearns foritselfhowyouthinkaboutthisquestion.

You'llcollectexamplesofhowyouanswerthequestionandusethemto trainamachinelearning"model"thatpredictswhatyouranswerwillbe.

6. Gotohttps://machinelearningforkids.co.uk/

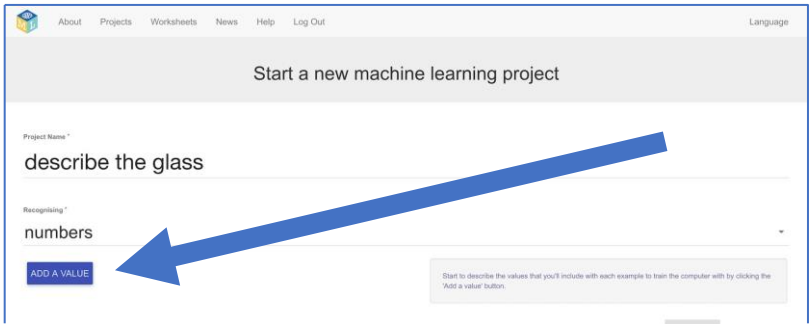
7. Clickon"**Getstarted**"

8. Clickon"**Tryitnow**"

9. Clickthe**"+Addanewproject"**button.

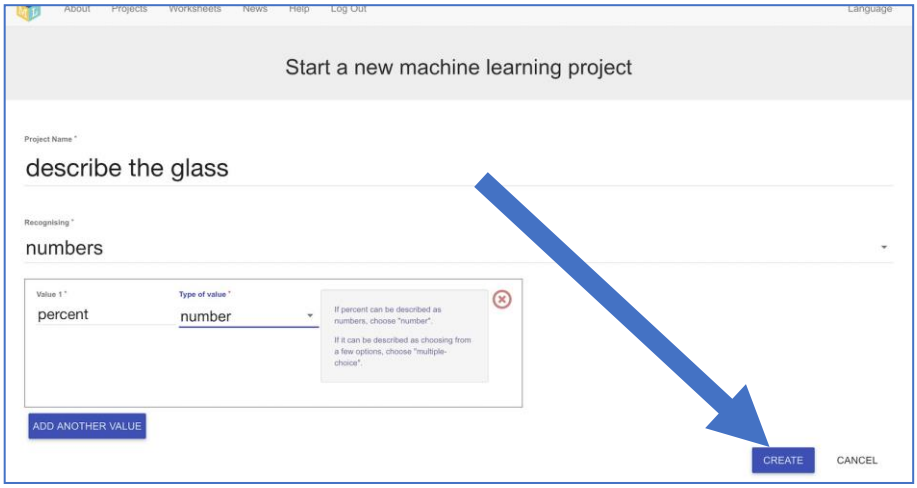
10. Nameyourproject"describetheglass"andsetittolearnhowto recognise "**numbers**".

11. Clickon"**Addavalue**"



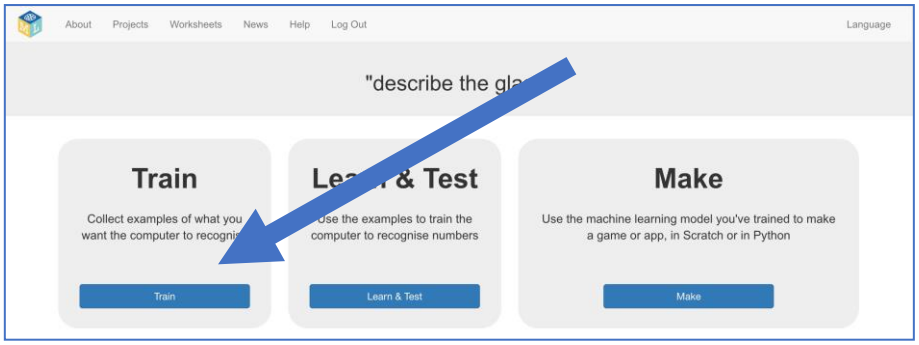
12. Createa“**number**”valuecalled“percent”

13. Clickonthe“**Create**”button

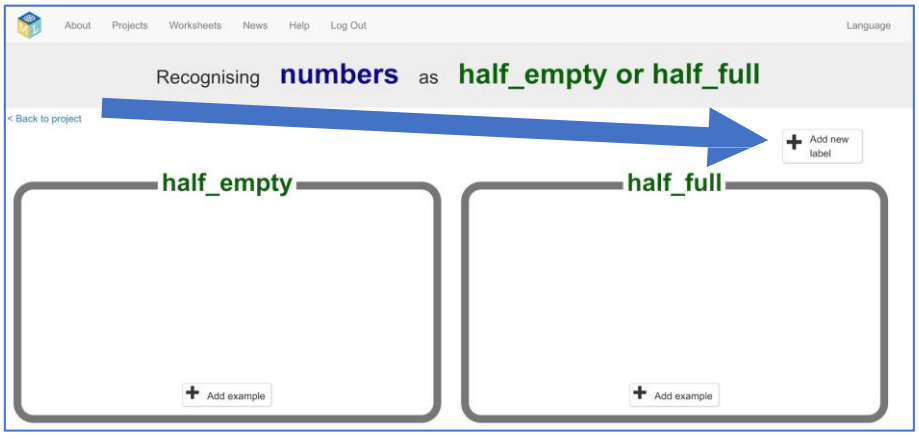


14. “describetheglass”willbeaddedtoyourlistofprojects.Clickonit.

15. Youneedtopreparethetypesofpredictionyouwantthecomputer to make. Click the “**Train**” button.



16. Click on **“+ Add new label**” and call it “half-empty”. Dothatagainandcreateasecondbucketcalled“half-full”.



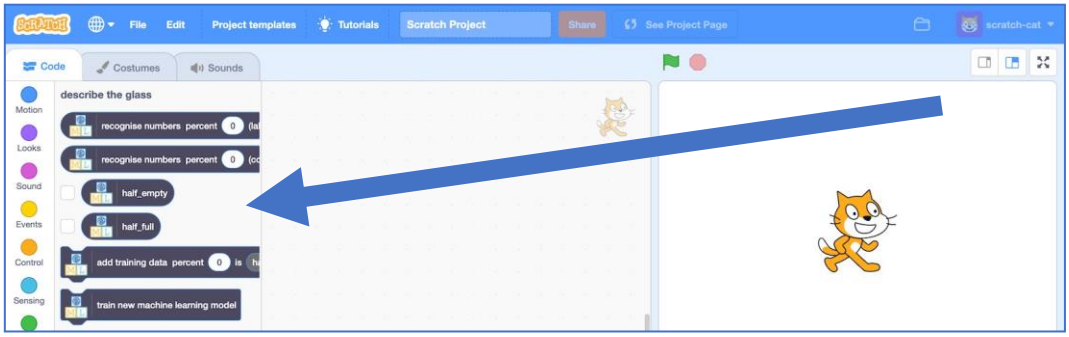
17. Clickonthe“**<Backtoproject**”linkinthetop-left

18. Clickonthe“**Make**”button

19. Clickonthe“**Scratch3**”button

20. Clickonthe“**straightintoScratch**”button

Thepagewillwarnyouthatyouhaven’ttrainedamodelyet,butthat’s okayasyou’llbeusingScratchtocollecttrainingexamplesfirst. Scratch will open with additional blocks from your project.

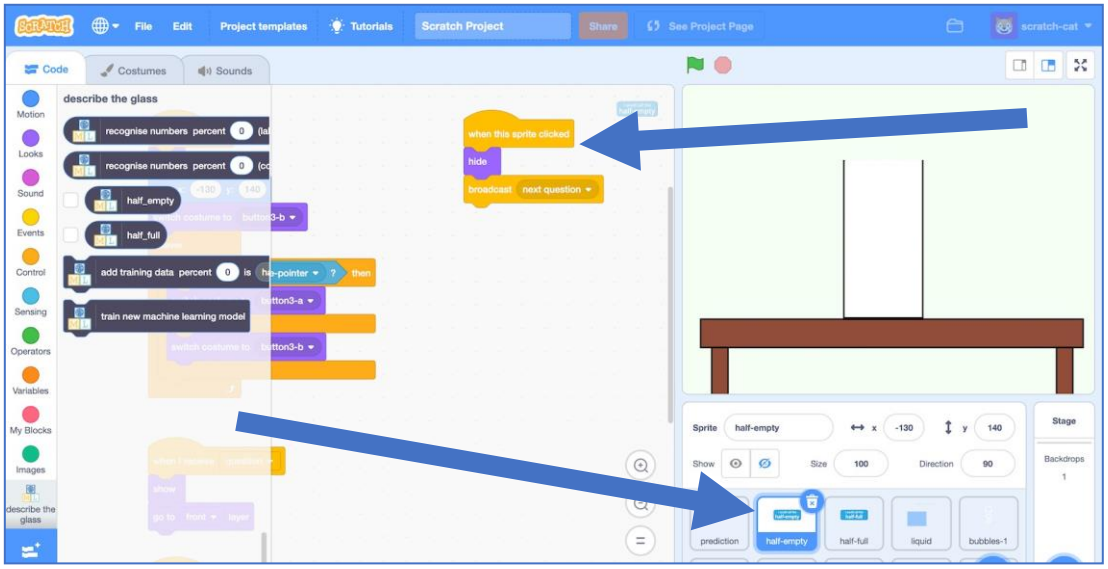


21. Clickonthe“**Projecttemplates**”button.

22. Openthe“describetheglass”projecttemplateagain.

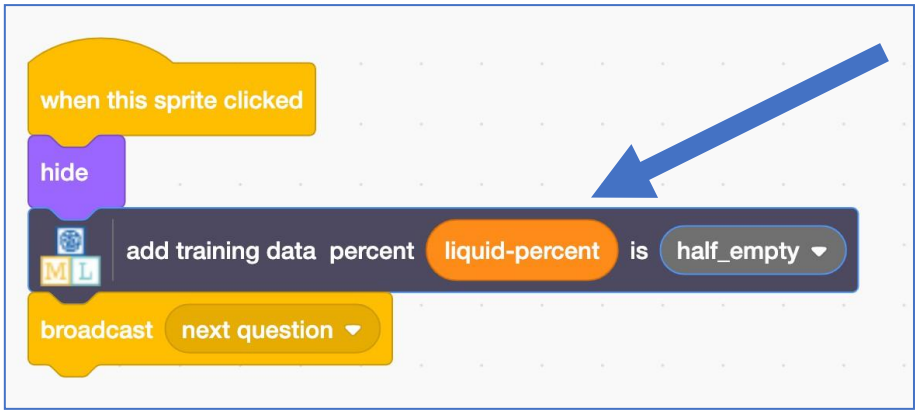
23. Clickthe“**half-empty**”sprite&findthe“whenthisspriteclicked”script

Thisisthescriptforthebuttonyouclickontosay“half-empty”



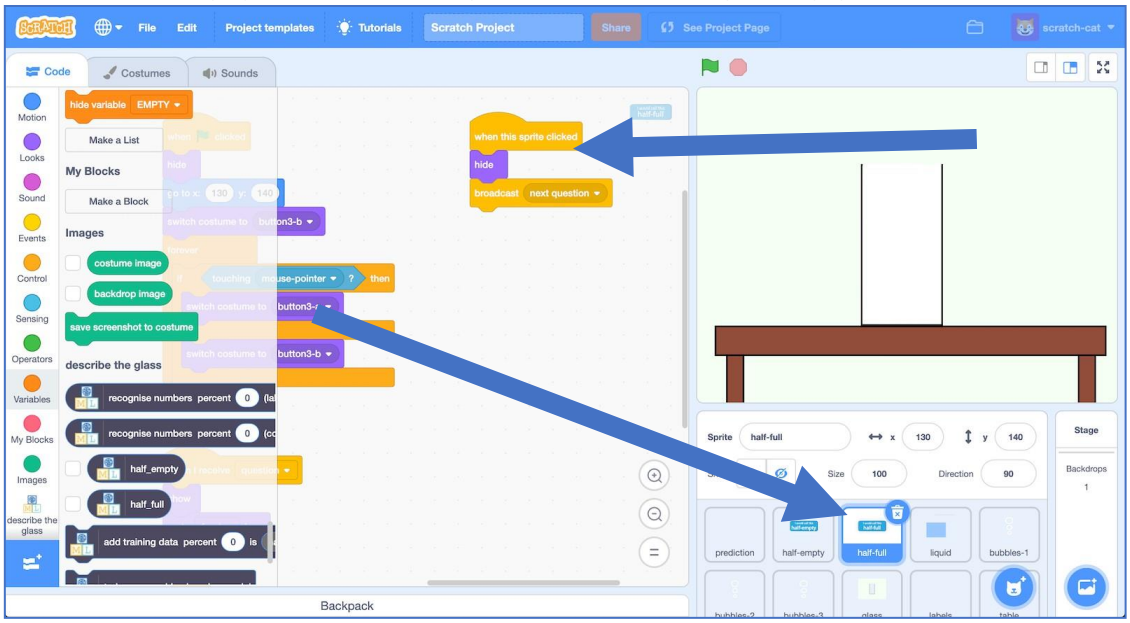
24. Addan“**addtrainingdata**”block,withthe“liquid-percent”value

Thiswilladdtheexampletoyourtrainingbucketfor“half-empty”



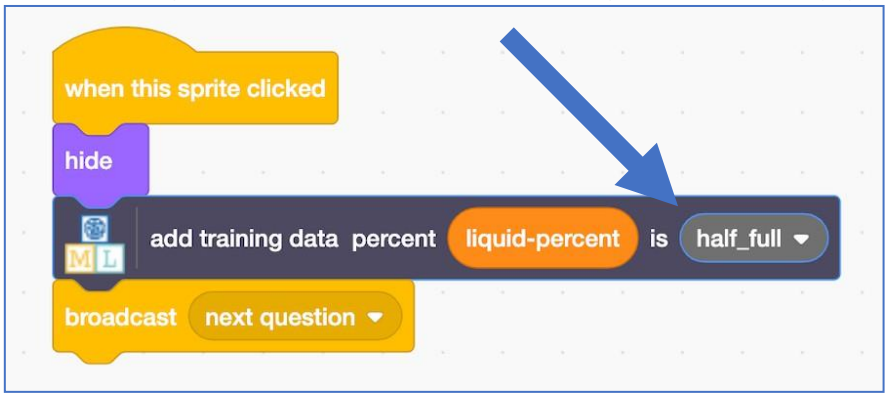
25. Clickthe“**half-full**”sprite&findthe“**whenthisspriteclicked**”script

Thisisthescriptforthebuttonyouclickontosay“half-full”

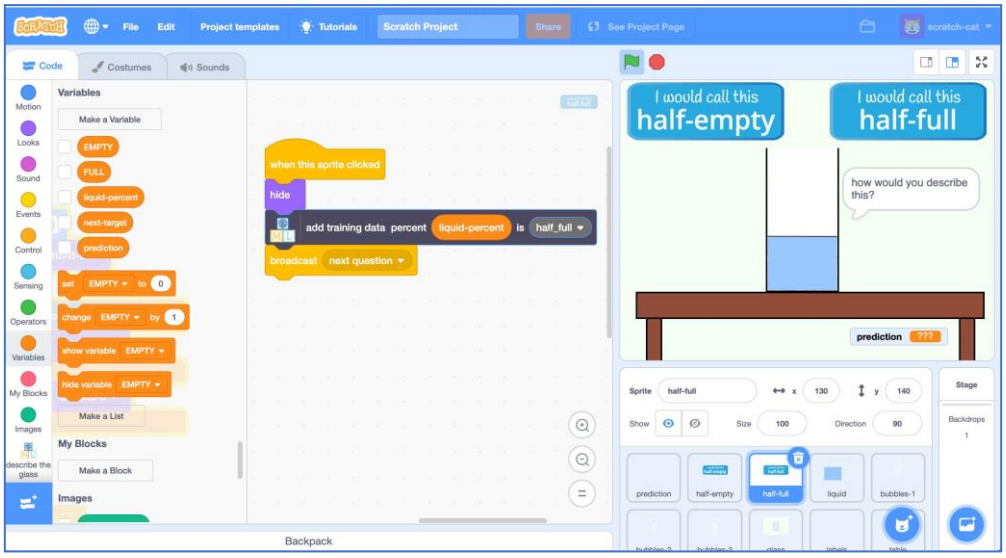


26. Addan“**addtrainingdata**”block,withthe“liquid-percent”value

Makesureyouchoosetoaddtheexampletothe“half-full”bucket



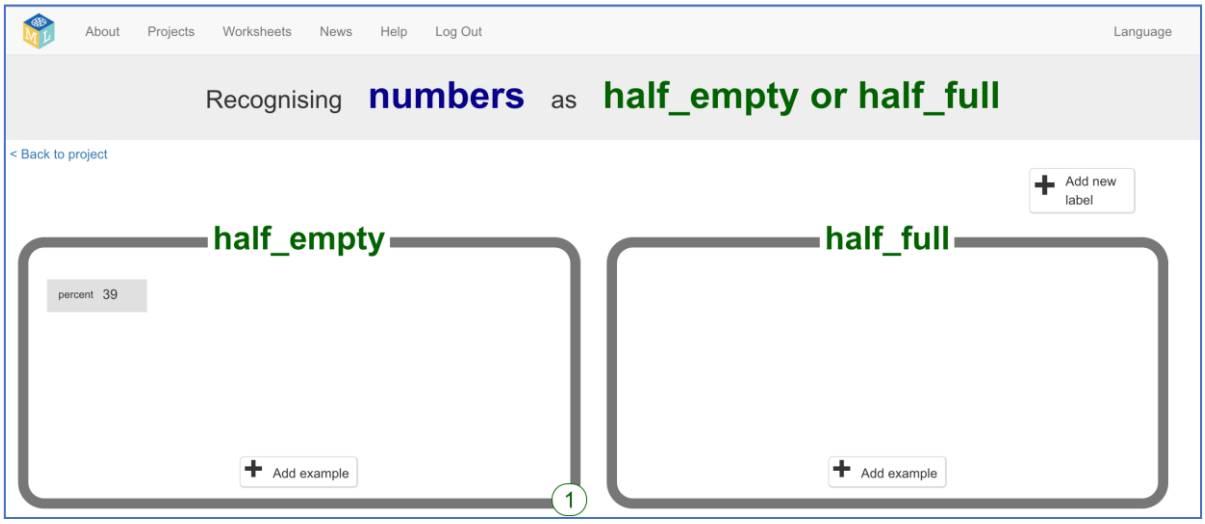
27. Clickonthe“**GreenFlag**”andanswerthe“howwouldyoudescribe this?” question once



28. Inyourotherwebbrowserwindowstillonthemachinelearning tool, click on the “**< Back to project**” link in the top-left corner.

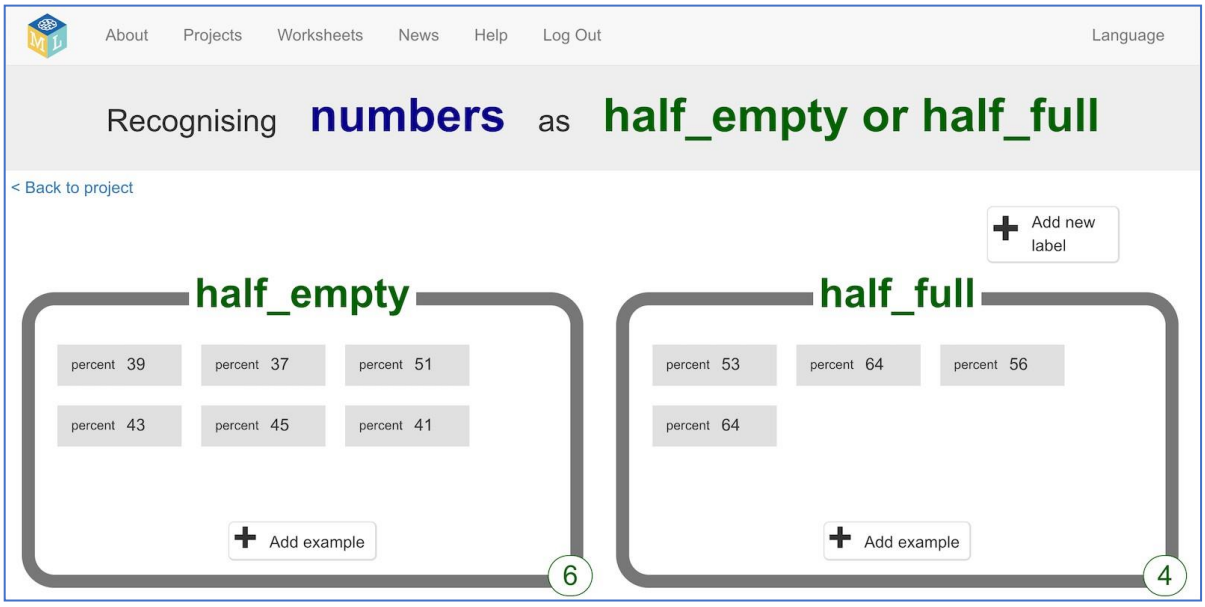
29. Clickonthe“**Train**”button.

30. Checkthattheansweryoujustgavehasbeenaddedtothetraining examples you will use to train the computer.

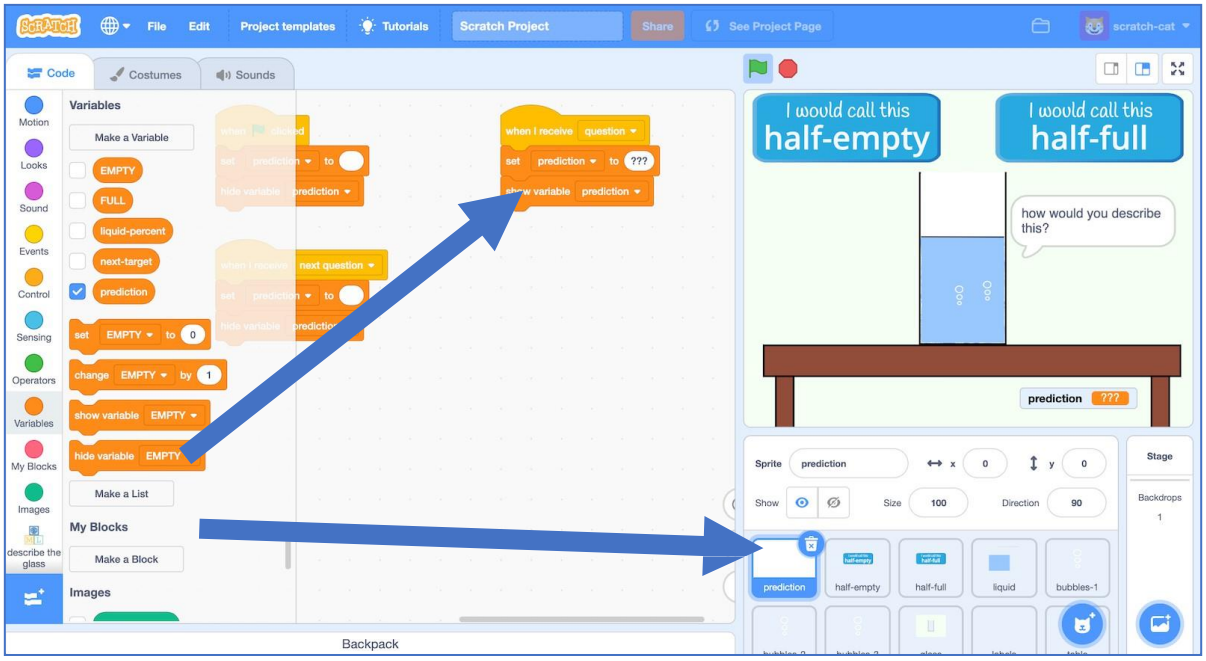


31. GobacktoScratch,andplaythegameagain**nine**moretimes. *Youmightfinditeasiertoplaythegameinfull-screenmode.*

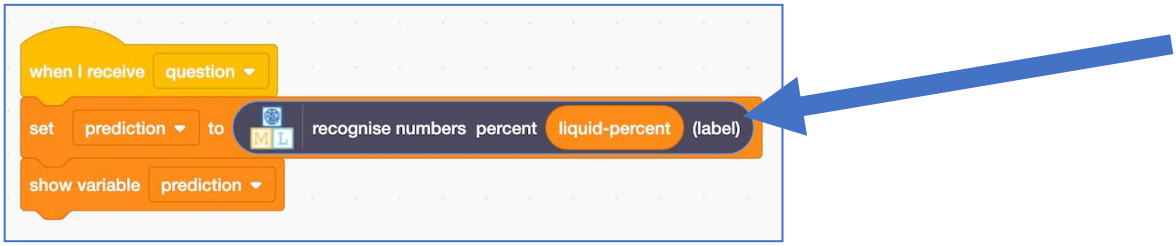
32. Checkhowmanytrainingexamplesyou'vecollected



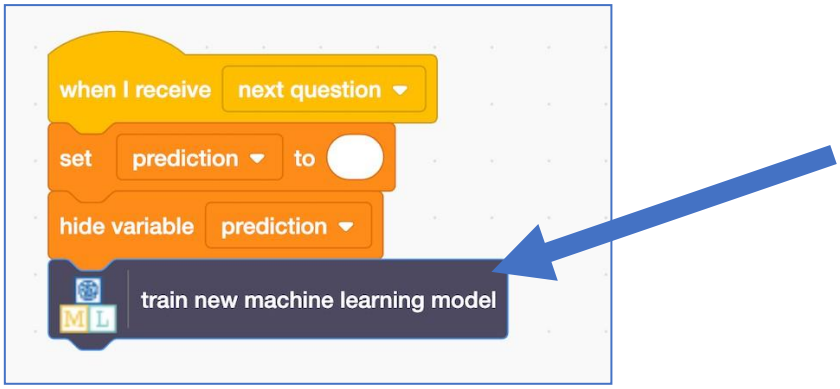
33. Clickthe"**prediction**"sprite&findthe"**whenIreceivequestion**"script *You should have enough examples now to try using a machine learning model to make predictions.*



34. Adda"**recognisenumbers…(label)**"blocktomakeaprediction



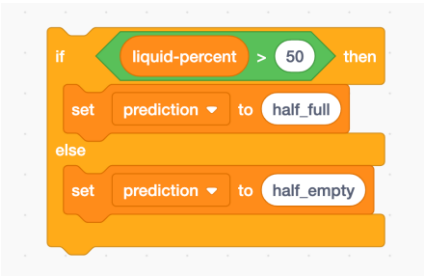
35. Findthe“**whenIreceivenextquestion**”script
Add a “**train new machine learning model**” block



36. Clickonthefull-screenbuttonandthentheGreenFlagagain
Howgoodisyourmachinelearningmodelatpredictingyouranswers?

Whathaveyoudonesofar?

You’vestartedtotrainacomputertopredictyouranswers.



Youcouldhavewrittenaruletodothis.

Forexample,ifyouknewthatyoualwaysdescribe more-than-halfas“half-full”andless-than-halfas “half-empty”,youcouldhavewrittencodelikethis.

Weusemachinelearningwhenwe’renotsurehowtowriteinstructions thecomputershouldfollow,orifwethinkthatwillbetoocomplicated.

Insteadofwritinginstructionsforthecomputertofollow,weletthe computerlearnforitselfhowitshoulddosomethingbyshowingit examples.

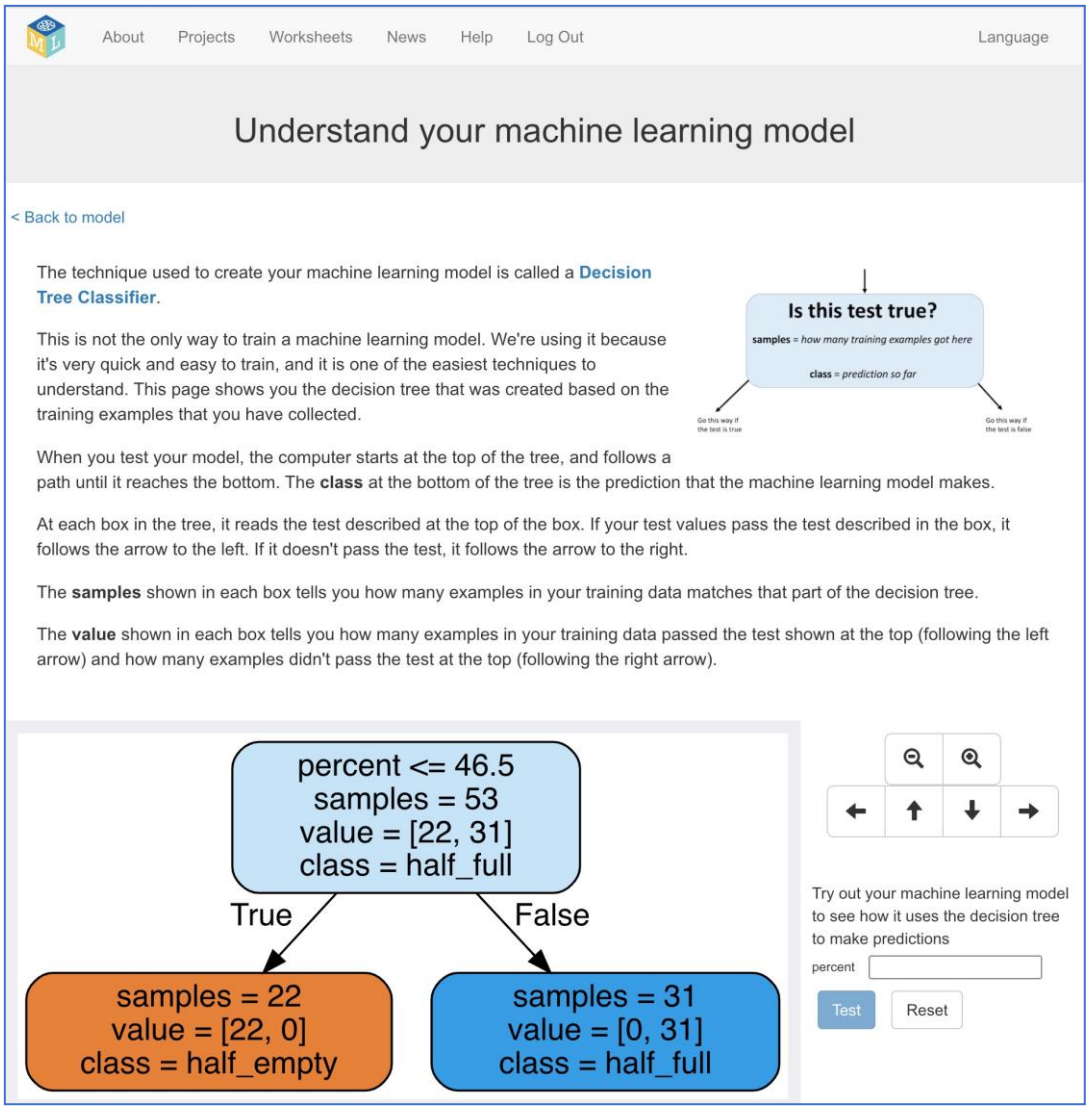
Thecomputerwilllearnfrompatternsintheexamples.Itwillusetheseto make predictions.

37. Onthemachinelearningtoolpage,clickthe“**<Backtoproject**” link

38. Clickon“**Learn&Test**”

39. Clickon“**Describeyourmodel**”

Thispagewillshowyouapictureofyourmachinelearningmodel. Readthepagetounderstandwhatitmeans.



Whathaveyoudone?

Thetypeofmachinelearningmodelyou'vetrainedisa"**decisiontree classifier**".Thevisualisationletsyouseehowyourmodelmakes predictions.It'sagoodwaytoseewhatpatternsthecomputerfoundin thetrainingdatayoucollected.

Thevisualisationwillshowthepatternsthatthecomputerobservedin your answers.

Forexample,inthescreenshotonthelastpage,youcanseethatmy machinelearningmodellearnedthatItendtodescribeanythingover46% as half-full.

Whatdidyourmachinelearningmodellearnaboutyouranswers?

Wasthatwhatyouexpected?

(Ifyouranswersweren'talwaysconsistent,yourmachinelearningmodel mighthaveamorecomplicatedvisualisationasthecomputertriedto showthedifferentwaysthatyouanswer.)

Trycomparingyourmachinelearningmodelwithamodeltrainedby someoneelse.Didthecomputerlearnthattheyweremoreorless optimistic than you?

IdeasandExtensions

Nowthatyou’vefinished,whynotgiveoneoftheseideasatry? Or

come up with one of your own?

Addadditionalpredictions

Insteadofjusthavingtwotrainingbuckets(“half-full”,“half- empty”) try adding more.

Forexample,trytrainingamachinelearningmodeltorecognize “nearly empty”, “half empty”, “half full”, “nearly full”

Addadditionalvariables

Whatotherfactorsmightinfluenceyouranswersapartfromthe amount of liquid?

Forexample,doyouanswerdifferentlyfordifferentcoloured liquids? Or different shaped glasses?
Whataboutiftheliquidhasincreasedordecreasedsincethelast question? Does that change how you answer?

Trymakingyourownprojecttoseehowthecomputerlearnsa more complex set of patterns that affect your answers.

Tryrecognizingthepictureoftheglass

Insteadoftrainingthecomputertorecognizehowfullaglassisby describing it with a number, we could have used a picture of the glass. Try doing this as an images project instead of numbers.