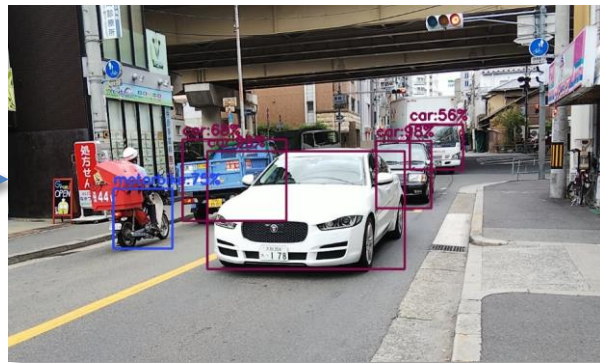

reference materials

Denaripam Corporation

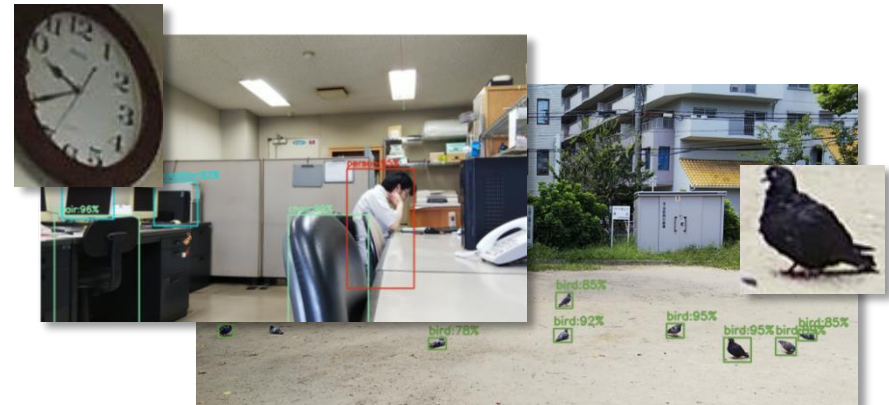
Technical verification Results

Validating an existing learning model

- AIAn existing learning model for object recognition.(YOLO+ Coco)Conduct verification of



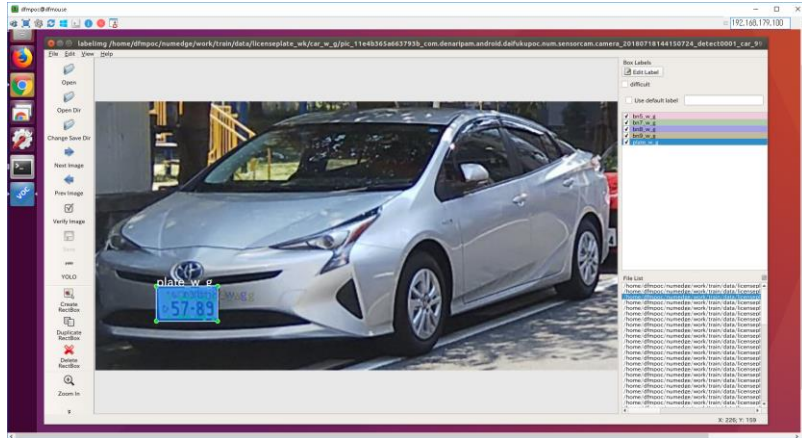
- YOLOAlgorithms andCOCO DatasetUsing a learning model using
- The recognition process isDArknetRun in
- Recognize the vehicle almost correctly as a recognition process
- People, watches, and pigeons were recognized outside the office as well as cars.



Validation results(AIRecognition and learning)

Production and verification of our own learning model

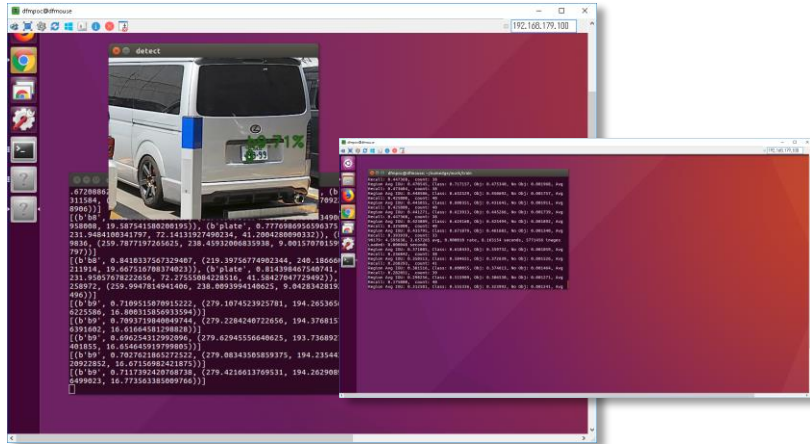
- AIrecognize license plate inBecause of its own learning modelProduction



- Plate recognition and number characters from the vehicle at the same timeRecognizeTo create a learning data set.

- The image of the data set is automatically cut out by the object recognition function produced in this case

- Add Annotation Data to the image and carry out the inflated



- LearningOnly part of the data was the result of recognizing the plate and the number

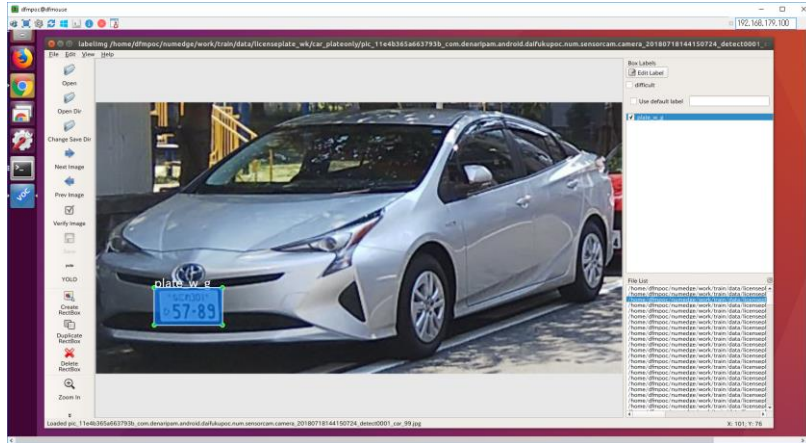
- Number of studies60,000Loss in3.8%Difficult to determine the learning data set.

- Change of plate recognition and number recognition in order to improve accuracy

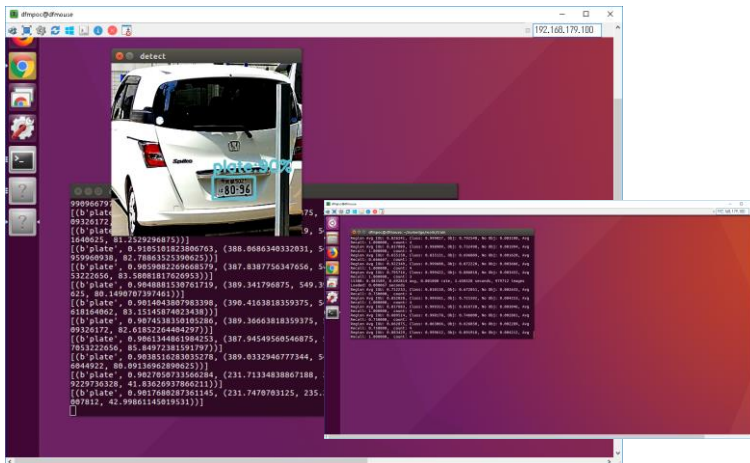
Validation results(AIRecognition and learning)

Production and verification of our own learning model

- Learning Model Verification Results Original Recreate the model to [Plate Learning Model Production]



- The policy is to create a learning data set that only recognizes plates from the vehicle.
- Data from the previous learning model
- Add Plate only Annotation Data to image, InflatedOfConducted

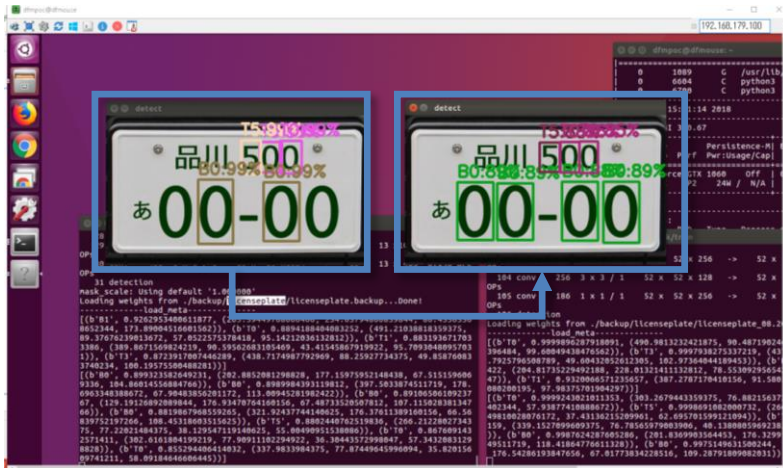


- Besides learning data and learning data License plate correctly. Recognize Was
- Number of studies 7,000 And Loss 0.3% Became
- A separate learning model is used to detect number characters.

Validation results(AIRecognition and learning)

Production and verification of our own learning model

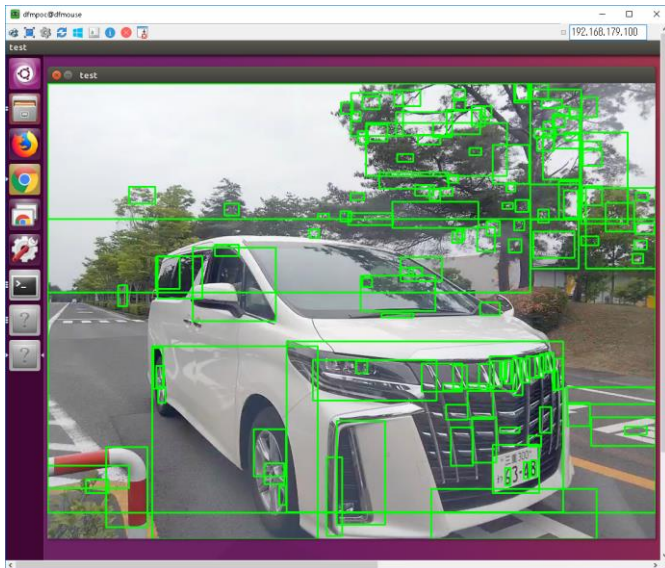
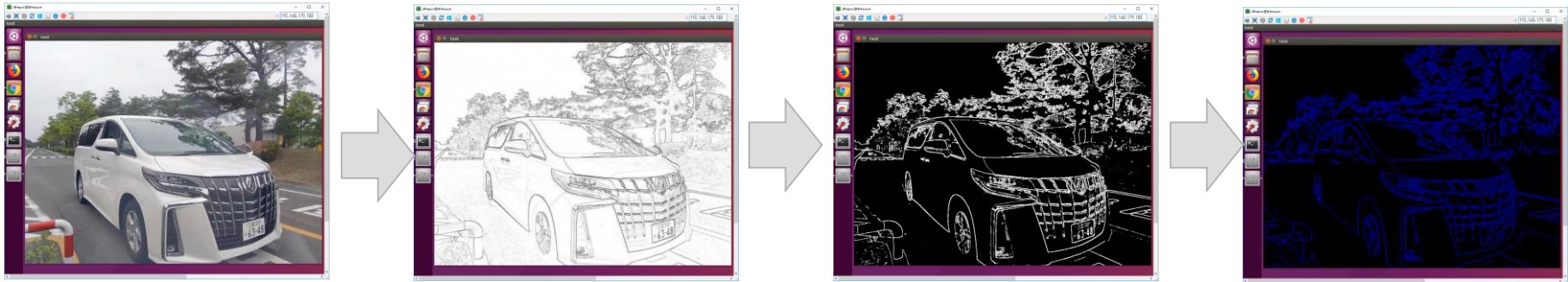
- Model re-creation based on learning model verification results[Number Learning ModelProduction]



- The machine learning system, the cut plate imageOcrOfTesseractocrAndRecognized but the accuracy was rather low(1CharacterAlsoRecognizeThere were many cases and)
- In deep learningOcrAs verificationMicrosoft·GoogleEtcAISystemOcrThe plate image that was cut out inOcrProcessedButMachine learning SystemOcrCases that are better but not recognizedButLot
- For the above results, eachCharacterA shape(Mark)To create a learning model that recognizes the shape of
- Because the character shape has few features, if the image is small, enlarge and image completion processing(High resolution)and increased the characteristics
- BranchAbbreviation(Region)TopNO Left hiragana and lowerNOEach with a shapeCreate a learning data set, as a recognition type70became more than a class
- Learning10000Times, loss rate2, learningNot recognized or mis-identified for dataBut until nowthan the method ofImproveExtraordinarily
- As a result of increasing the variation of the learning data and re-learning, the recognition accuracy improved.. Re-learning while improving repetitive learning dataCanIt seems to improve accuracy in

Image processing and image recognition Technical verification

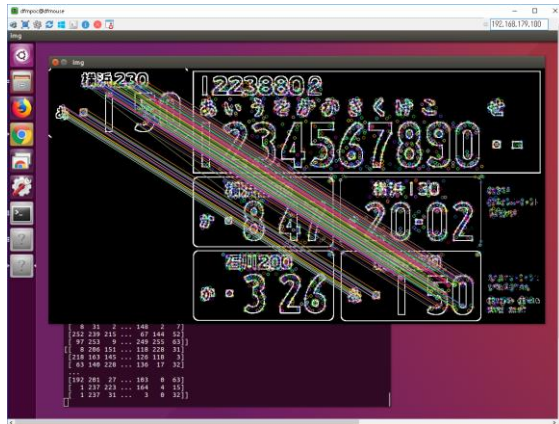
- It is necessary to recognize the license plate for the study method. Image processing Technology Validate



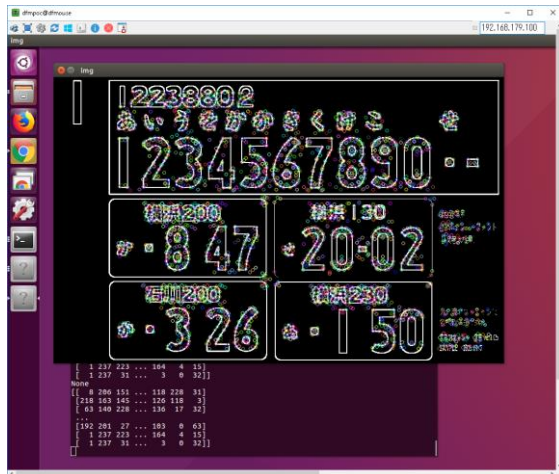
- Processing images to extract recognized characters from images
 1. The image is processed into the illustration form
 2. Image to Value of
 3. 2Extracting feature points from value images
- Feature points To involve Extract Squares(AIO of Object detection Close information)
- AI Use Without (To some extent) The recognition of license plates and letters could be verified.

Image processing and image recognition Technical verification

- For the study method, Verification of image recognition technology required for license plate recognition



- Extract feature amount based on each feature point
- Recognize other images with the same feature amount(The line in the left figure ties the recognized feature.)
- It is possible to recognize a certain degree even if there is a difference of the size of the recognition image to judge it as a feature amount.

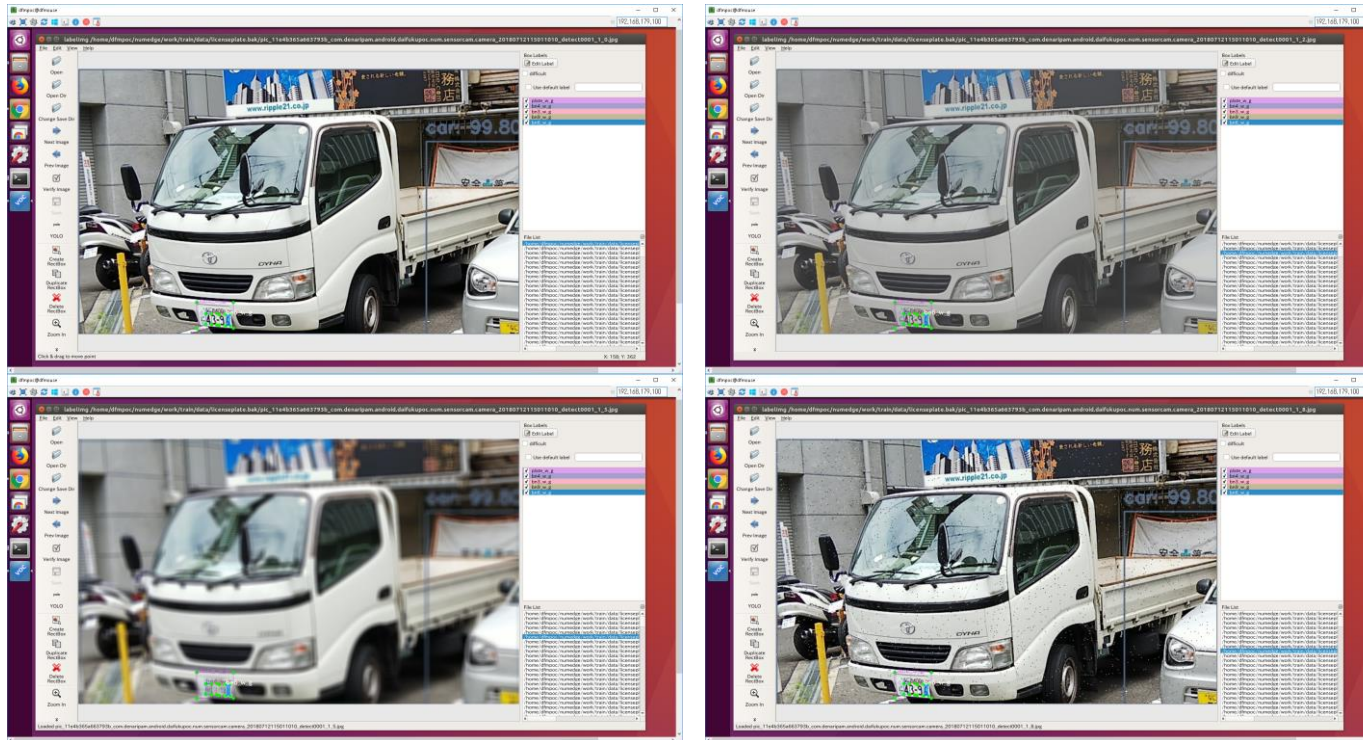


- As a matter of fact, it is not possible to extract a shape without a feature. Especially 1 such as a number that has a simple shape such as
- Numbers without license plate characteristics(Especially 2 After the value etc. image processing) is difficult to detect.

Validation results(Learning data Generation)

Verification of learning data generation method

- Study data set Mizumasu processing for learning efficiency, etc.



XAbout10Pa
ttern

- Processing based on image + annotation information
- Smoothing-NoiseAddition etc(About10Pattern)Image conversion for learning dataSetTo inflate
- Learning data for learning and teaching(The whole10Degree)AndAlso effective when separating

Sensor terminal



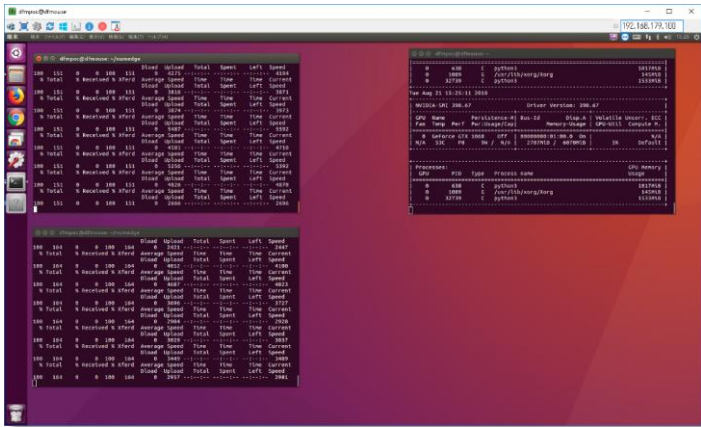
Challenges

- External temperature, camera, communication processing, etc. by feverOs There are problems such as forced suspension of the app from Found

Measures

- The load-intensive continuous communication process, dynamic detection, etc. Implemented the ability to take precedence when processing is not done (Already supported)
- of automatic shooting Start and end By scheduling and implementing features that do not allow for unnecessary time (Already supported)
- As a sensor device, UsbCamera Etc Edge Equipment directly to Use devices that can be connected and are not affected by heat Do (Plan)

Edge Equipment



Challenges

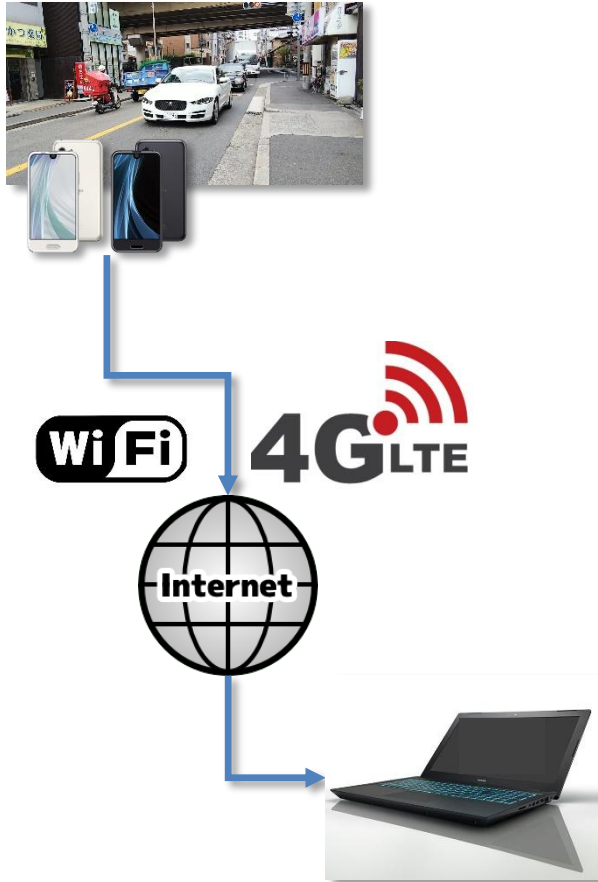
- AIAt the time of recognition and learningGpuIt is found that there is a problem of the termination etc. When memory is not trivial



Measures

- Implementation of use memory adjustment at the time of learning model execution (Already supported)
- RecognizeProcessing isDarknetThe maximum3-4Can run the learning model at the same time(Already supported)

CommunicationRelated



Challenges

- Mobile Phone communications network(Data communication onlySim) Data inTransferSpeed is situational and slowButFound(※Measurement10MThere is a case to fall to the following extent)

Measures

- Consecutive videosTransfer ratherIn the sensor deviceDynamic detectionDo shootingStill imagesToSequentialTransferChanged to a method to(Already supported)
- If the line is slow and not connected, it is stored in the sensor device and the function to transmit when the communication line becomes available is implemented.(Already supported)

Other AI Environment About building

VirtualPc+ ExternalGpuUsingAIEnvironment

Prototype development environment

The following environment for prototype development Built, Features As Existing Pc To AI Add an environment that can be processed Can

Test EdgePc

VirtualPC Virtualbox) Built in

VirtualPC On the Linux Ubuntu 16 To run

VirtualPC Because it is created in Usb In memory, etc.

The other Pc To be transferred as it is Possible

ExternalGpu

Intel Movidius Neural Compute Stick To

VirtualPC To Connect AI Used for processing

Yolo DataSet To Mobilenet-SSD And

The model that has been learned AI Used for processing

Target category

"Background ", "Aeroplane", " Bicycle ", " Bird ",
"Boat", "Bottle", "Bus", "car", "cat", "chair", "cow",
"Diningtable", " dog ", " horse ", " motorbike ", " person ",
"Pottedplant", " sheep ", " sofa ", " Train ", "Tvmonitor"

