HACETTEPE
ÜNİVERSİTESİ

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Internship's subject: Software

Internship Start Date: 2/07/2018

Internship Finish Date: 10/08/2018

Internship Duration: 30 Work-day

Company Name: Mavinc of Information Industry and Trade Inc.

Company Address: Üniversiteler Mah. Hacettepe Teknokent 4.Ar-Ge Binası 1596.Cad. No:95/5, Beytepe, 06800 Çankaya/Ankara.

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1. INTRODUCTION

1.1. Internship's Subject

Developing a user interface for a computer Vision algorithm called Yolo.

1.2. Internship Goals

- Learn to use and deploy Yolo Algorithm on linux systems, using a graphical user interface
- Learn the basic of image processing techniques using Opencv library
- Learn the basics of c++ programming
- Learn the basics of QT framework

1.3. Internship Process And Result In General

Through the internship duration, i was a part of a team consists of 5 people, a professor as the team leader, 2 PhD Candidates, 1 Master student, 1 intern like me.
The team was working on a project developing an intelligent control and analysis system for Surveillance Camera system. My role in the project, was to desgin and build a prototype for the final project's interface using QT framework and openCv library.

2. ABOUT THE COMPANY

Mavinci is an R&D company working especially in information and communication technologies, security and defense areas with the capability of software development, technical support, domain expertise and consultancy. The operational areas are; Nuclear Safety Research and Analysis, Disaster and Emergency Management, Decision Support Systems, Command and Control Systems, Chemical Biological Radiological and Nuclear Security Solutions, Image Processing, Modeling and Simulation, and Project Management. The goal of the company is to develop novel technologies and to produce network centric key products with innovative solutions.

3. INTERNSHIP PROCESS

The overall duration of the internship was 30 work-days, which is equivalent to 6 weeks.

3.1 1st week

know the companies and the other employees Knowing which project that i will be part of, and with which people i will work

During my first week at the Mavinci company, i got to know the people working there, who were from different educational backgrounds, like physics engineers, nuclear engineers and computer engineers.

In the company there was a lot of ongoing projects, that cover a lot of different areas like Security Solutions, Image Processing, Modeling and Simulation, and Project Management.

During the meetings that are held between the participated interns and the some junior engineers; the junior engineers explained the ongoing projects in details like what work is done and what work to be done, also what are the technologies that are used in those projects.

After we got an overall view of the projects that the company is working on, they asked us to choose, which projects we wish to participate in and they helped us on that, considering our knowledge on those areas.

For me, there was a relatively new project, that the company has just started; which was related to computer vision. So i chose to work on it, because i have some knowledge of computer vision from the course that i toke in our department.

And the computers are prepared to be used and Yolo algorithm is been explained in general

3.2 2nd week

After we have been assigned to the projects and everyone has known his or her role in their projects, The company gave to everyone of us a personal computer to use; while doing our project.
For me, i installed the following tools and IDE's to use them on my project:

0- Ubuntu 18.04 operating system
1- Pycharm IDE Professional Edition: A development environment for Python
2- Visual Studio Code : A general code editor
3- QT Creator: A development environment for C and C++, as well as QT gui framework

As my environment is ready to use . i started researching about Yolo algorithm and learn how it works and how it can be installed on a linux system.

Yolo is a state-of-the-art algorithm for object detection and classification

3.3 3rd Week

During the third week, i started to learn OpenCv library (Open Source Computer Vision) . which is a major library that is used in almost every computer vision application.

OpenCv provides the implementation for almost every algorithm in computer vision like thresholders, smothers and trackers etc.

OpenCV is written in C++ and its primary interface is in C++. There are bindings in Python, Java and MATLAB/OCTAVE.

İ learned the basics of OpenCv; because the project that we are working on is heavily a computer vision related project, so learning OpenCv was very essential step.

3.4 4th WEEK And 5th week

During the fourth and the fifth week, i started to learn the fundamentals of c++ programming language and parallel to it, i was learning the QT framework; which is framework that use c++ for user interface design.

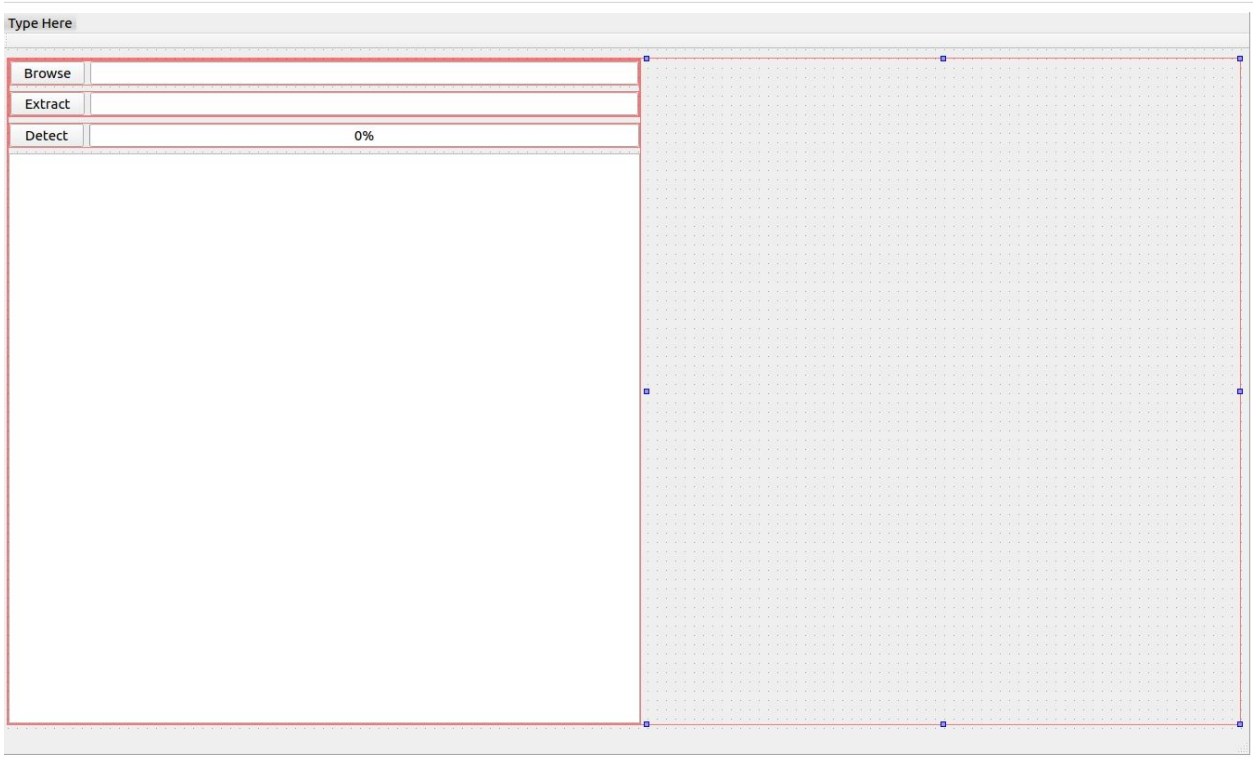
Qt framework is s a cross-platform application framework and widget toolkit for creating classic and embedded graphical user interfaces, and applications that run on various software and hardware platforms with little or no change in the underlying codebase, while still being a native application with native capabilities and speed

I used QT framework to later design the user interface for the demo project.

3.5 6th Week

As the last week came, the demo project had to be designed and implemented.
The purpose of this demo project was to provide a graphical user interface to Yolo (An object detection algorithm).

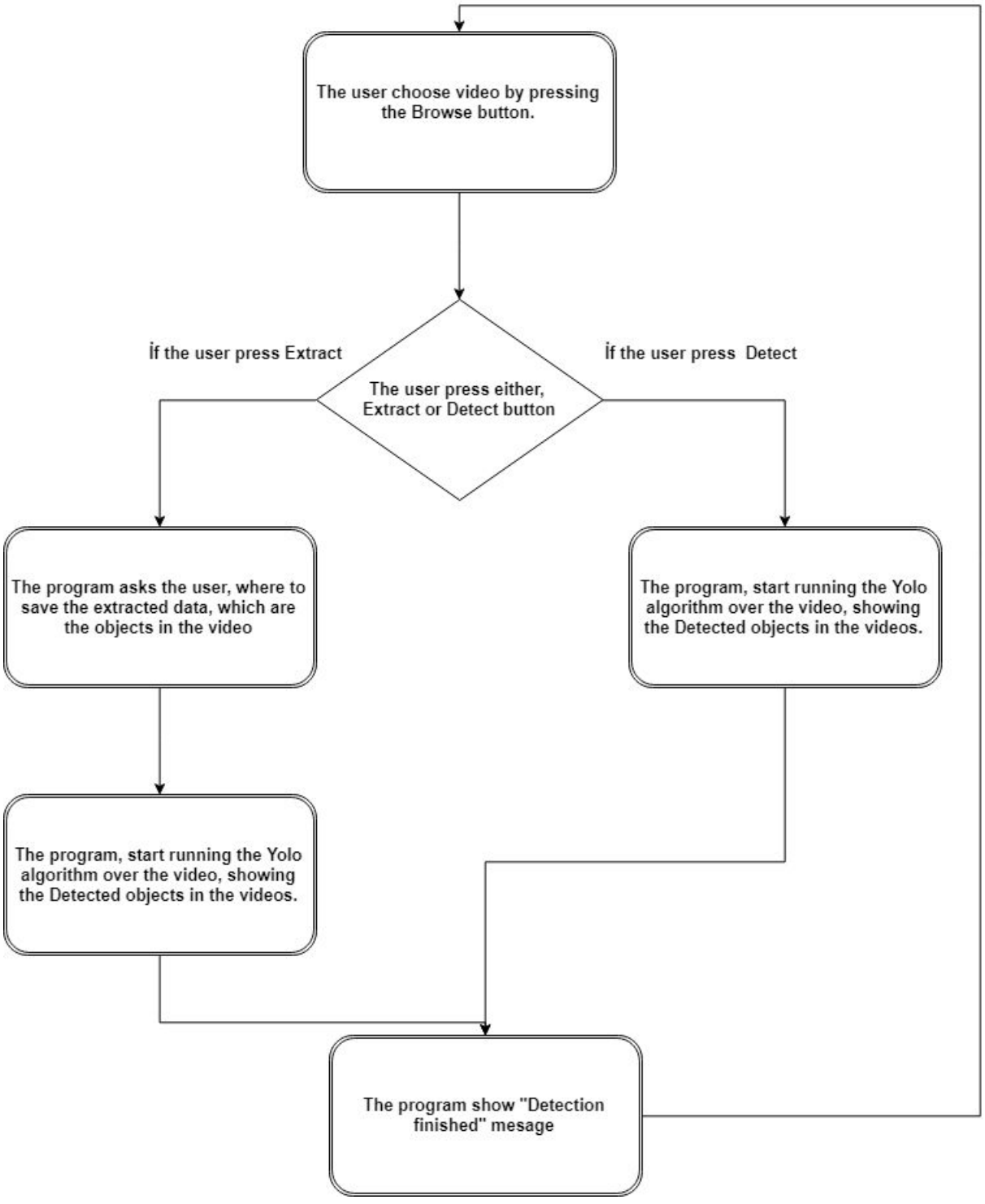
The user interface designed as follow (The detection process is not running)



A screenshot for the program while the detection process is running (with input):

Ask anıl for it later

The flow of the program


The user choose video by pressing the Browse button.
The user press either, Extract or Detect button
İf the user press Extract
İf the user press Detect
The program asks the user, where to save the extracted data, which are the objects in the video
The program, start running the Yolo algorithm over the video, showing the Detected objects in the videos.
The program, start running the Yolo algorithm over the video, showing the Detected objects in the videos.
The program show "Detection finished" mesage

A screenshot for some parts of the code:

```
#include "mainwindow.h"
#include "ui_mainwindow.h"

#include <QMessageBox>

MainWindow::MainWindow(QWidget *parent) :
    QMainWindow(parent),
    ui(new Ui::MainWindow)
{
    ui->setupUi(this);
    this->_yolo = new Yolo();
    this->_yolo->loadNames("/home/mavinci/darknet/data/coco.names");
    this->_yolo->setClasses(80);
    this->_yolo->loadNetwork("/home/mavinci/darknet/cfg/yolov3.cfg",
"/home/mavinci/darknet/yolov3.weights");

    //What does the timer do here??
    this->_timer = new QTimer();
    QObject::connect(this->_timer, SIGNAL(timeout()), this,
SLOT(timerTick()));

    this->_isOnDetection = false;
}

MainWindow::~MainWindow()
{
```

```
    if(this->_capturer != nullptr)
        delete this->_capturer;
    delete this->_timer;
    delete this->_yolo;
    delete ui;
}

void MainWindow::browseClicked(){
    if(this->_isOnDetection){
        QMessageBox::warning(this, "Uyarı", "Obje algılayıcı zaten
çalışıyor!");
        return;
    }
    QFileDialog dialog(this, "Select a Video File",
QDir::home().path(), tr("MPEG4 (*.mpeg4 *.mp4);; AVI (*.avi);; All
files (*.*)"));
    dialog.setFileMode(QFileDialog::ExistingFile);
    if(dialog.exec()) {
        QString filename = dialog.selectedFiles()[0];
        this->ui->browseLineEdit->setText(filename);
        if(this->_capturer != nullptr)
            delete this->_capturer;
        this->_capturer = new VideoCapture(filename);
        this->_timer->setInterval(1000.0 /
this->_capturer->getFPS());
        this->ui->detectProgress->setValue(0);
    }
}
```

```
void MainWindow::detectClicked()
{
    if(this->_isOnDetection){
        this->_timer->stop();
        this->ui->detectButton->setText("Detect");
        this->_isOnDetection = false;
        this->ui->videoLabel->setPixmap(QPixmap());
        this->ui->detectProgress->setValue(0);
        this->_capturer->reset();
        return;
    } else {
        this->_timer->start();
        this->ui->detectButton->setText("Stop");
        this->_isOnDetection = true;
    }
}

void MainWindow::extractClicked()
{
    if(this->_isOnDetection){
        QMessageBox::warning(this, "Uyarı", "Obje algılayıcı zaten
çalı$ıyor!");
        return;
    }
    QFileDialog dialog(this, "Save Metadata", QDir::home().path(),
tr("Text (*.txt)"));
    dialog.setFileMode(QFileDialog::AnyFile);
    dialog.setAcceptMode(QFileDialog::AcceptSave);
    if(dialog.exec()){
```

```
        QString textname = dialog.selectedFiles()[0];
        this->ui->extractLineEdit->setText(textname);
        this->_extractFile.setFileName(textname);
        this->_extractFile.open(QIODevice::WriteOnly);
    }
}

void MainWindow::timerTick()
{
    if(this->_capturer->frame() >= this->_capturer->frameCount()){
        this->_timer->stop();
        this->ui->detectButton->setText("Detect");
        this->_isOnDetection = false;
        this->ui->videoLabel->setPixmap(QPixmap());
        QMessageBox::information(this, "Title", "Metadata çıkartma
tamamlandı.");
        return;
    }

    if(this->_capturer->readNext()){
        QImage qim = this->_capturer->getCurrentFrame();
        QVector<Detection> dets = this->_yolo->detect(&qim);

        //ex: Frame: 1 / 10
        // cat ....
        // Dog ....
        QString frameline = QString("%1%2/%3\n").arg("Frame: ",
QString::number(this->_capturer->frame()),
QString::number(this->_capturer->frameCount()));
```

```
        for(int i = 0; i < dets.size(); i++){
            frameline.append(dets[i].toString());
            frameline.append("\n");
        }
        frameline.append("\n");
        this->ui->metadataTextEdit->append(frameline);
        if(this->_extractFile.isOpen()) {
            QTextStream ts(&this->_extractFile);
            ts << frameline;
            ts.flush();
        }
        QImage drawed = this->_yolo->paintDetections(qim, dets);
        drawed = drawed.scaled(this->ui->videoLabel->size());
        this->ui->videoLabel->setPixmap(QPixmap::fromImage(drawed));
        int progress = (int)(100.0 * this->_capturer->frame() /
this->_capturer->frameCount());
        this->ui->detectProgress->setValue(progress);
    }
}
```

4. RESULTS

1. Learning a various technologies, like OpenCv and c++
2. Learning how meetings are done and organized inside the company
3. Learning how to communicate and share ideas with other team members
4. Learn how big projects are being planned
5. Developing a small project and uploading it to my GitHub account, so i can share it later

5. RESOURCES

- YOLO

  https://pjreddie.com/darknet/yolo

  https://medium.com/@jonathan_hui/real-time-object-detection-with-yolo-yolov2-28b1b93e2088
- OPENCV:

  https://en.wikipedia.org/wiki/OpenCV

  https://opencv.org/
- QT FRAMEWORK

  https://en.wikipedia.org/wiki/Qt_(software)

  http://doc.qt.io/qt-5/qtexamplesandtutorials.html
- C++

  https://www.tutorialspoint.com/cplusplus
- Mavinci information industry and trade inc company's website

  https://www.mavinci.com.tr/