Self learning software to identify illegally traded orchid material

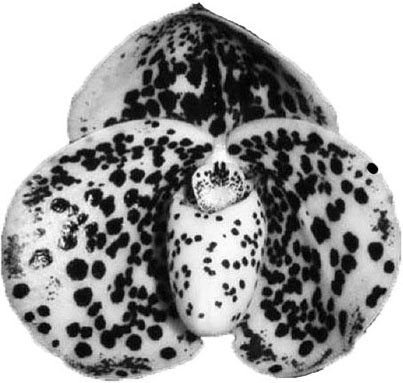


Figure 1 *Cypripedium calceolus* [1]

Patrick Wijntjes, s1057924

University of Applied Sciences Leiden, Bio-informatics, Technology cluster  
Zernikedreef 11  
2333 CK Leiden

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ECTs: 59

Naturalis Biodiversity Center  
Sylviusweg 72  
2333 BE Leiden

Supervisors:  
Dr. Barbara Gravendeel and  
Dr. Rutger Vos

Lecturer from school:  
Drs. Jan Oliehoek

# Abstract

During this internship the concept of classifying slipper orchids to section level from pictures was tested. To test the possibilities of classifying from pictures, first pictures of well-identified orchids were collected. From these pictures, different sets were created, one for training Artificial Neural Networks (ANNs) and one for testing them. The results show that some sections were harder to classify than others. Adding new pictures to the train set could improve the classification, but could also worsen the classification, depending on the quality of the new pictures and how well the new networks were trained. In general, better-trained networks were able to correctly classify slipper orchid flowers, showing that visual recognition software can be used for identification of these orchids.

To make the classification software available to the outside world, a first concept of a website was developed. Users can upload a picture of a slipper orchid flower to the website. The website then runs the classification software using the given ANN. The result of this script will be translated to a human readable result. This result is returned to the website.

With this application, the Dutch customs can check imported plants. The website improves the classification and helps the customs to prevent illegally import of slipper orchids.

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# Introduction

## Illegal trade in endangered orchids

There are thousands of different orchid species known all over the world [2]. None of these are allowed to be imported into the Netherlands without CITES permits. Since 1973 orchids are primarily protected by the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), which is signed by over 120 nations [3]. Despite this convention many orchids are illegally traded. To trade species that are protected by CITES, a licence or certificate is required.

It is difficult to monitor the illegal trade of orchids because some orchids look very similar to non-protected plants and so accurate identification can be very difficult. To improve identification, software that can identify orchids from pictures of tubers, leaves or flowers could be vital. This software would in particular aid custom officers and employees of nature conservation organizations involved in confiscating illegally traded material.

## Slipper orchids

During this project, the focus was on slipper orchids and orchids from which *salep* is produced.

In Europe and Asia the slipper orchids (Cypripedioideae) are widely distributed between sea level up to 2000 m altitude. They prefer to live in calcareous environments and are found in deciduous or mixed deciduous and coniferous woods. They grow best in light to deep shade. The slipper orchid is an herbaceous perennial plant species that has a long lifespan. It can grow up to 60 cm and each season the slipper orchid will produce new growths. Each stem of the orchid can contain 3 to 4 leaves that often have upwardly curved sides. The flower stalk can be one-flowered or two-flowered with leaf-like bracts. The sepals and petals are rarely green but commonly brightly coloured. These sepals and petals are also often twisted [4]. Slipper orchids are highly desired ornamentals.

Ground orchid bulbs of the Orchidoideae, also known as *salep,* are very popular in Turkey and adjacent countries in central Asia. They are used to produce ice cream in summer and hot drinks during winter. *Salep* is also used as medicine. In the early 1990s the trade of *salep* increased strongly. Official statistics from the Turkish State Institute of Statistics shows that the export between 1995 and 1999 was 282.000 kg annually. To achieve this amount of *salep* 9.825.000 – 19.650.000 bulbs are required. It is unknown if this information is related to pure *salep*, substitutes or mixtures. However, as this harvesting is unsustainable, laws have been established to protect these orchids. In Turkey there are three laws that would protect them: The first law is the Turkish Forest Law, which regulates the use of non-wood forest products. In short this law states that it is forbidden to collect and remove any form of forest vegetation. The second law, the Turkish Law of Natural Parks, states that “The production of forest products, hunting and disturbing the natural balance is prohibited.” Since collecting *salep* is classified as production of forest products, it is prohibited in all protected areas. The last law in Turkey is The Regulation on Collection, Production and Export of Bulbs of Wildflowers. As the title of this law suggests, this law regulates the production and the export of bulbs, roots and tubers of flowers. It also holds a list with species that may not be taken away from the wild for export [5]. As mentioned earlier, the exact ingredients in *salep* cannot be identified without molecular identification tools, which makes it difficult to enforce these laws.

## How a web application can improve control in illegal orchid trade

To make it easier to follow the trade routes of orchid smuggling, a web application that can identify different orchid species is desired. This application could be used on laptops/desktops and smartphones/tablets by taking pictures of flowers, leaves or underground tubers and uploading the pictures to a website. A simple workflow of the application can be found in figure 2. In this project the focus was on creating the website and integrating the identification application for pictures taken of flowers of slipper orchids. This application is currently under development at Naturalis.

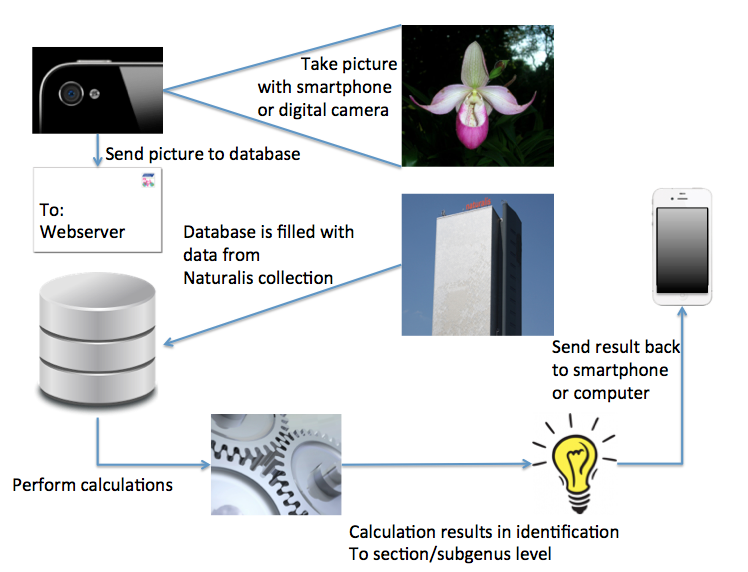


Figure 2 A simple workflow of the application made during this project. Resources of the pictures: [6-15]

## Comparable software

There is software available that can identify a person using face recognition, for example the software KeyLemon [16]. This software could be used to unlock a computer.

Essentially the software takes a picture or series of pictures of your face. When it takes a series of pictures it is almost always required to move your head up and down and / or left and right. The software saves this picture / these pictures. When you use the software to unlock your computer the software takes a picture / a series of pictures of your face and compares this picture / these pictures with the saved picture(s). When it finds a match you will be logged-in to your own account. The existence of this kind of software proves that it is possible to identify objects that look very similar to each other, like two different persons. If this is possible, it would also be possible to identify orchids to section level. All sections have some very specific characteristics that are unique to that section.

This software differs from the pipeline that was developing during this internship in several aspects. First of all, this software is made to recognize a human face. The pipeline that was developed during this internship focused on slipper orchid flowers and *salep* orchid tubers.

Secondly the pipeline will be available on a website, while the comparable software needs to be installed on the local machine.

Lastly, this software is usually not available for mobile devices. Because the pipeline will be available on a website, mobile devices also have access to it.

## Goal of this internship

The goal of this internship was to proof that it is possible to classify slipper orchid flowers from pictures of them. When this concept was proved the classification software was trained very well. Once the classification software works almost perfectly, it will be available online. Customs then can use this software to prevent illegal import of slipper orchids.

# Materials and Methods

## Website

During this internship a website was developed. Users of this website can upload a picture to the server. On the server the software will classify the orchid on the picture to section level.

The processes behind this website, like clicking on a button, are written in Python 2.7 using the Django package. The layouts of the webpages are written in html, using css style sheets. There are two versions of every html file, one for computers and one for mobile devices. The different css style sheets, html files and python scripts can be found in appendices 3.2, 3.3 and 3.6.

## Flickr

To store the pictures in a safe place where they are accessible to whoever needs them, a shared Flickr account was created. Flickr is a website for saving and sharing pictures. It is not allowed to share the pictures of the flowers, so the settings of the Flickr account were set on private. This means that only persons with the account name and password can access the pictures.

On Flickr it is possible to add tags to the pictures. These tags are used later in the preparation process to save the pictures in the correct directory. To download the pictures and the metadata via the command line, a python script written by Hugo Haas, Offlickr.py, was modified and used (see appendix 3.5.1) [18].

Before training of the neural network is possible, a preparation process is needed. The first step in this process is to download the pictures and metadata and search for the tags in the metadata. An example of the metadata can be found in appendix 2.1. The blue square indicates the location of the tags. The next step is to convert the pictures from jpg- to png-format. Finally the pictures will be placed into the correct directory (Round, Spur and Oblong for the different *salep* orchid tubers, LRound, LSpur and LOblong for the different look-a-like tubers and the correct section and species for the slipper orchid flowers) using the tags. After separate the pictures of the tubers from the flowers the pictures of the tubers will also be split. This means that the background is fully made white and the flower is cut out of the picture.

## Training

### Slipper orchids

During this research the neural networks were trained to see the differences between seven sections of the slipper orchids. These sections were *Barbata, Brachypetalum, Cochlopetalum, Coryopedilum, Paphiopedilum, Pardalopetalum* and *Parvisepalum*, which are based on molecular phylogenetic research [\*].

The script that trained the network was already developed at Naturalis by Rutger Vos. This script accepts a parameter to specify the Desired Error. This is the maximum error rate that will be accepted. If the parameter is left empty the Desired Error will be 0,0001. When the error comes below this threshold the training is finished. To find the optimal Desired Error, seven networks were trained whit a Desired Error ten times less then the network before. So the first network had a Desired Error of 0,0001, the second network had a Desired Error of 0,00001 and so on. The expectation was that a network with a lower Desired Error would classify a new picture better. To semi-automate the preparation for the training some scripts were written in python and bash. The workflow of these scripts can be found in figure 3. These scripts were for training the Artificial Neural Networks (ANNs). This is only done by administrator of the website and not by the end-users. The administrator has access to the shared Flickr account, so the manual check (and download) that is required for one of the scripts, would not be a problem.

### Salep orchids

The tubers of look-a-likes of salep orchids that were used were from *Arum maculatum*, *Asparagus officinalis, Polygonatum verticillatum, Tulipa greigii,* and *T. sp.* [17]. Appendix 1 contains pictures of these tubers.

Before training of the software was possible, there were many steps to prepare the training. First of all, pictures of the *salep* orchid tubers and the tubers of the look-a-likes were required. So in the first few weeks of this research project pictures of *salep* orchid tubers and tubers of look-a-likes were taken at the Sylvius lab. Although the orientation of these tubers was unregulated, it is required that it is the same for all pictures. For instance, if the first picture of a tuber with appendices has the appendices on the right, all other tubers with appendices must have the appendices on the right as well. The user has to use the same orientation as the trainer. The background has to be one colour, like white or black, and this colour must be the same for every picture. The last requirement is that there is only one tuber on the picture.

Figure 3 Workflow of training preparation scripts. Blue: preparation steps. Green: processing step to produce useful data for training the flower Artificial Neural Networks. Purple: Training of the Artificial Neural Networks

## 

## Testing the networks

### Slipper orchids

After training the networks for the slipper orchid flowers, they were tested on pictures of four sections of slipper orchids. The tested sections were *Barbata, Brachypetalum, Coryopedilum* and *Parvisepalum*. The networks were also tested with pictures of some primary hybrids of *Parvisepalum* and *Brachypetalum* with the aim of testing if it is also possible to find hybrids with the software. The results of these tests can be found in supplementary 1. Some results of the first test round were very bad. To find the source of these bad results, pictures of some bad classified species were checked on the characteristics of the corresponding section. Table x holds a list with the characteristics per section based on Cribb P [#]. The results of this research can be found in supplementary 3. During this research it was also discovered that some species had only one picture in the train data. After this finding extra pictures were added to the train data and the networks were trained again to find out if better results could be obtained after more extensive training. These networks were tested again with the same test sets. The results of these tests can be found in supplementary 2.

Table 1 characteristics per section

|  |  |  |  |
| --- | --- | --- | --- |
| *Barbata* | *Brachypetalum* | *Coryopedilum* | *Parvisepalum* |
| Spathulate petals | Broad-elliptic petals | Long petals | Broad-elliptic petals |
| Spotted and/or warted petals | Variously ornamented with purple spots | Petals hanging down | Subcircular petals |
| Incurved side lobes | Small lip | Incurved side lobes | Large staminode |
|  | Ovoid lip | Spirally twisted petals | Cream/yellow coloured petals |
|  | Lip with incurved margin | Warts on margins of petals |  |
|  | Pale yellow or white flower | Glandular at tip |  |
|  |  | Tapering petals |  |

### Salep orchids

Due to time constraints, pictures of these orchids could not be investigated further during this internship.

## Testing the website

To test the website a working network was required. After testing the networks a working network was implemented on the website. This website was tested on receiving a picture, running the classify script using the given network and sending back a result. First this was tested for only one device. Once this was working correctly, the website was also tested to receive pictures from more than one device at the same time and send a result back. Receiving the pictures was working correctly, but sending back a result was not. The result of the first uploaded picture was send back to all devices. So this part of the website was made operable during this internship.

# Results

## Website

To make the software available for end-users a website was developed. The first design of this website was finished during this internship. It contains a homepage, a page for uploading a picture, a page to show the picture is uploaded correctly, and a result page. On the homepage it is possible to choose to upload a picture or remove the unused files from the server. For the last option it is required to log in with a valid account. A workflow of this website can be found in figure 4. Figure 5 zoomed in on the uploading part of the website. The workflow of the classification step of the website can be found in figure 6 and figure7 is a workflow of the script that translates the result of the classify script to a readable result.

After selecting the upload option the user is forwarded to the upload page. On this page the user can select a picture to upload. On iPhones it is also possible to take a picture after tapping the “select file” button. The website will check whether the selected file is a picture. If it is not, the user stays on the upload page and a warning is issued. After uploading the file, the name of the picture is modified behind the scenes. When these modifications are done the user is directed to the upload success page. Here the user can see the uploaded picture. The user can choose to see the results or cancel. If the user selects the result option, the classify.pl script will run to classify the picture (see appendix 3.4.1). The output of this program is a list with numbers. An example of this output can be found in appendix x.y.z. This list is sent to a python script, result.py, that translate this list to a readably result (see appendix 3.x.y). This result is sent back to the result page, where the user can view it. Supplementary 4 contains screenshots of this website.

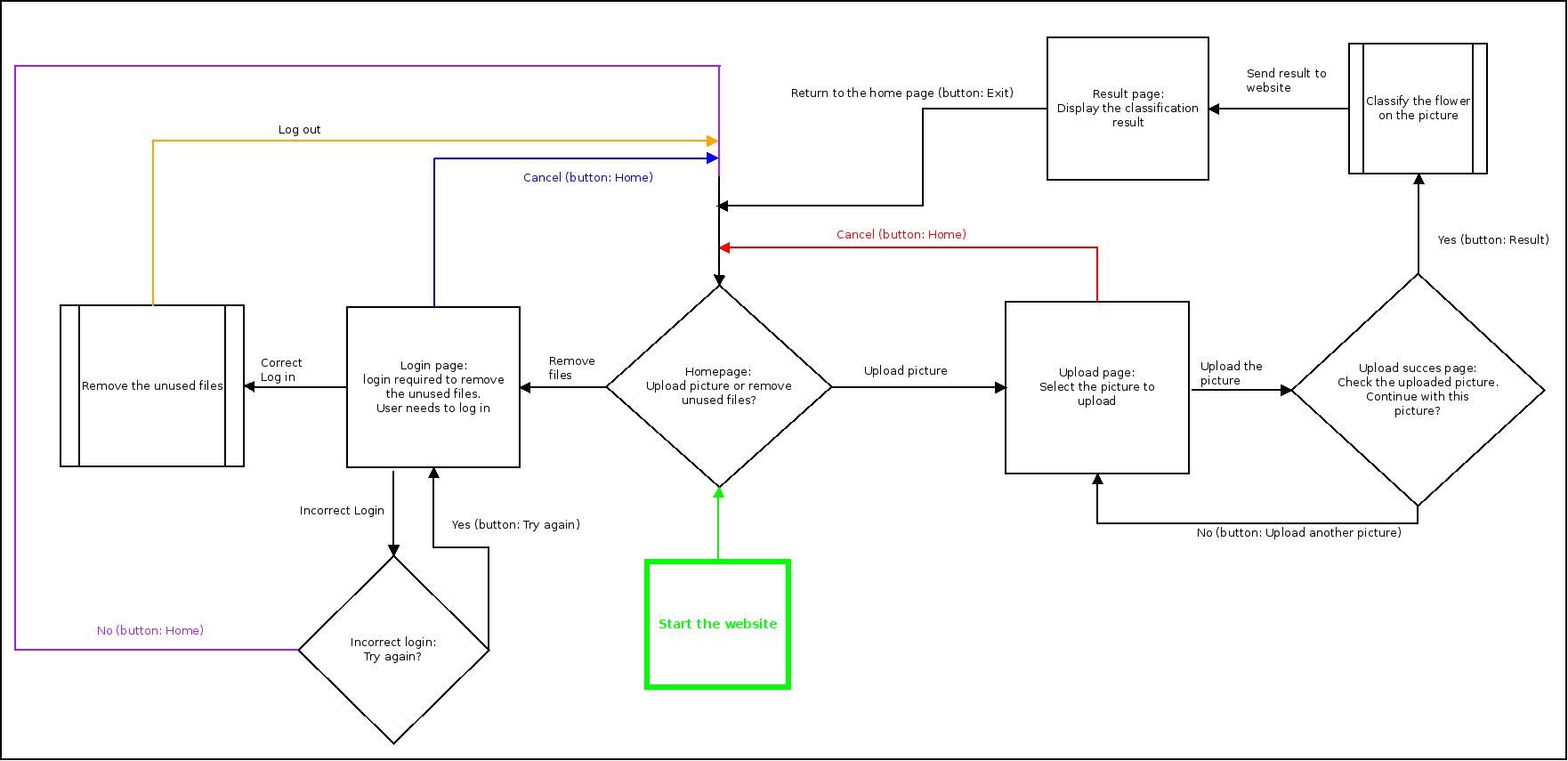


Figure 4 workflow of the website. Green: start of the workflow, start the website.

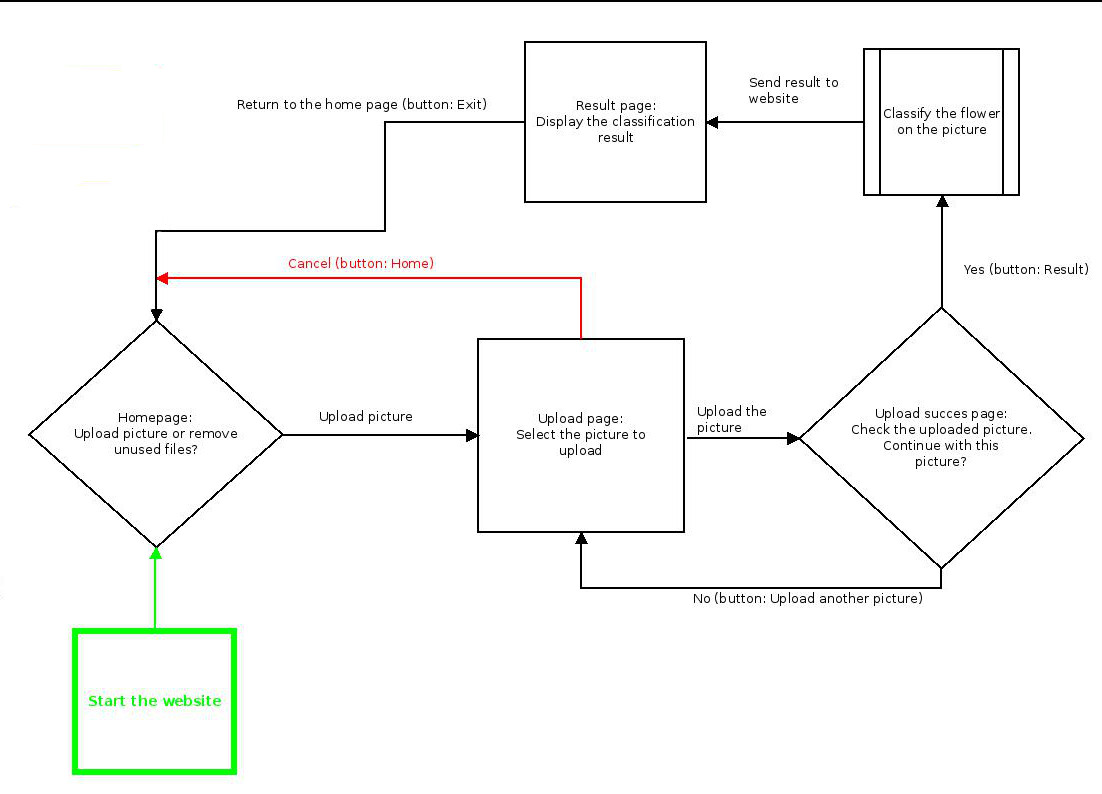


Figure 5 Workflow of website, zoomed in on uploading. Green: Start of the workflow, start the website.

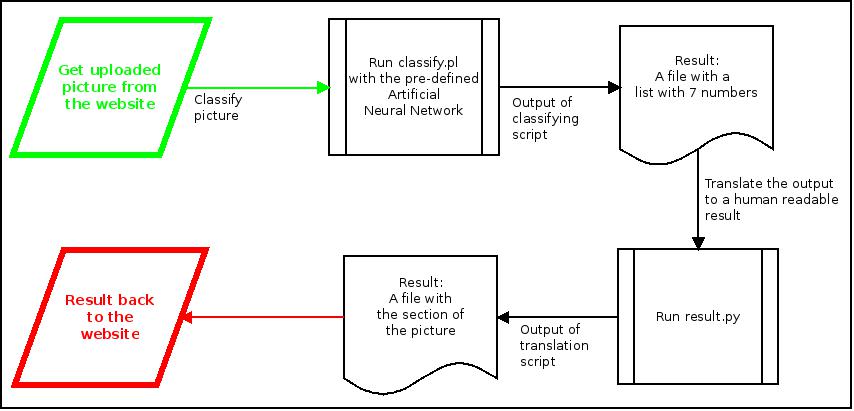


Figure 6 Workflow of the classification step of the website. Green: Start of the workflow, get the picture, Red: End of the workflow, send the result.

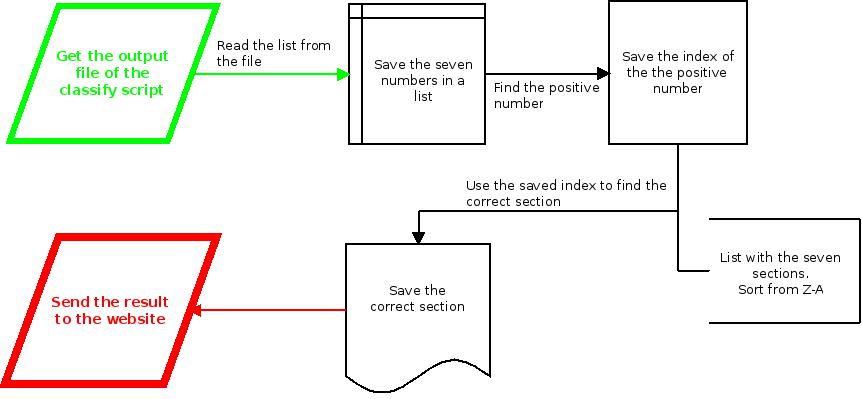


Figure 7 Workflow of result.py. Green: Start of the workflow, get the input file. Red: End of the workflow, send the result.

## Preparation scripts

To semi-automate the preparation process, a bash script, training.sh, was developed (see appendix 3.1.1, and the first script in figure 3). Figure 8 contains a workflow of this script. The first step in this script was running Offlickr.py to download the pictures as .jpg and the metadata files as .xml. After downloading these files, the script will run another python script, get\_tags.py (see appendix 3.5.2), to get the original names and the tags from the metadata. A workflow of this script can be found in figure 9. This info will be saved in .txt files, using the id of the picture as name. For example, if the picture name is 123456789.jpg the tag file of this picture is 123456789\_tags.txt. At the end of this step the .xml files are removed. Example of different tag files can be found in appendices 2.2-2.4. The structure of these files is always the same: the first line is the original name of the picture, then an empty line, after that the section for the flower pictures and the shape for the tuber pictures, the species and lastly a tag that indicates whether the object is a slipper orchid flower or a *salep* orchid tuber. The knowledge of this structure can be used in the next step.

In the next step the pictures are divided between two directories, Flower and Tuber. Before the pictures and tags are moved to the correct directory, the pictures were converted from .jpg to .png. This convertion was required because the training scripts only works with png files. After converting the pictures, the .jpg files were not used anymore, so all .jpgs files were removed.

After dividing the pictures between the directories Flower and Tuber, the separation goes further. First the Flower pictures are divided between the different slipper orchid sections and species. After this division there are some directories with the section names inside the Flower directory, and every section directory contains further species directories. After dividing the Flower pictures, the Tuber pictures are divided between shape and Look-a-Like or orchid. This step will produce six directories: LOblong, LSpur, LRound, Oblong, Spur and Round. All directories starting with an “L” are for the Look-a-Like tubers.

The last step in the preparation process is splitting the pictures of the tubers, using a Perl script developed by Rutger Vos: splitter.pl (see appendix 3.4.1). This script used a Perl package, named Image::Magick, to modify the picture so that only the tuber is on the picture, with a minimum background. With an option of Image::Magick the background is modified to be completely white (see the square in appendix 3.4.1). Figure 8 shows a picture before and after splitting. The pictures of the flowers are already split, so this step was not required for these pictures.

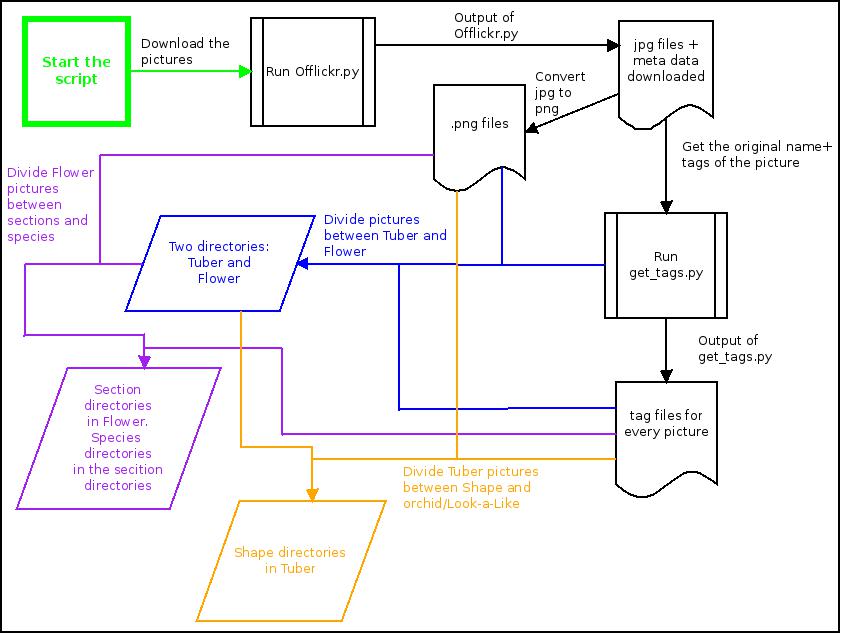


Figure 8 Workflow of training.sh. The colour of the arrows indicates in which step they were involved.

## Create training data

When the preparation script is finished the training data can be generated. To do this, a bash script, create\_traindata.sh, is developed (see appendix 3.1.3, and the second script in figure 3). This script runs two different Perl scripts developed by Rutger Vos. One of these scripts is for the tubers and the other for the flowers (see appendices 3.4.2 and 3.4.3). The only difference between these two scripts is the accepted input files. The script for the tubers only accept files with a name in the format <number>,<number>.png, while the other script accepts files with a name that contains at least one number. These scripts create tsv (tab separated value) files for every directory. So after running create\_traindata.sh there is a tsv file for every species of the flower pictures and a tsv file for every shape of the tuber. These tsv files contain the intensities of Red, Blue and Green (RBG) of 50 vertical points and 25 horizontal points. This means that the classification is based on colour.

The tsv files of the tuber can be used for training the neural network. The tsv files of the flowers need to be modified before using them for training the neural network. To automate this modification process a bash script is developed that will run two python scripts (see appendix 3.1.2, the second script in figure 3 and appendices 3.5.3-3.5.5). The first python script creates tsv files per section by combining the tsv files in that specific section. When all sections have a tsv file the second python script will be running. This script creates extra columns, one column per section. After creating the columns they will be filled in. The guideline for this step is: the first section gets 1’s in the first column and -1’s in all other columns. The second section gets 1’ in the second column and -1’ in all other columns etc. After this step the data can be used to train the neural networks.

## Neural networks

After completing all these preparation steps a neural network can be trained. To train the network a Perl script, trainai.pl, is used (see appendix 3.4.x). This script accepts a directory with tsv files, the number of categories (is number of extra columns), the output file, a Desired Error and the maximal number of epochs. The last one is the number of rounds the network will be trained. When this number is reached, the training process will stop.

Because the network is trained with the tsv files, it is trained to see patterns in the colour intensities of RBG. Now the network acts like it can see different colours.

During this project 14 ANNs were created for identifying slipper orchid flowers. Seven for the first test run and seven for the second test run. As mentions earlier the Desired Error is lowered ten times per network.

The networks can be found on:

<https://github.com/naturalis/img-classify/tree/master/webapp/ann>

All ANNs with a name ending with a ‘4’ were used for the first test run and all ANN’s with a ‘5’ are used for the second test run. Due to time constraints, no networks could be created for tubers of salep orchids and look-a-likes.

## First test run

During the first test run four of the seven sections, *Barbata, Brachypetalum, Coryopedilum* and *Parvisepalum* were tested. The ANNs were also tested with a few pictures of the hybrids of *Parvisepalum* and *Brachypetalum*. The results of these tests can be found in supplementary 1. The different networks are shown horizontally and the different pictures vertically. A green cell with the text correct means the network has classified the picture to the correct section. A yellow cell with the text Unknown means the network was unable to classify the picture. A yellow cell with the text Unknown <number>/<number> means the network was unable to select a section. When this text is green, one of the options is the correct section. A red cell with the text Incorrect <number> means the network classified the picture to a wrong section. The number indicates to which section the network classified the picture. Below, the obtained results will be discussed in more detail.

### Section *Barbata*

This section is characterized morphologically by… Most of the species of the section *Barbata* were classified incorrectly. As seen in table … in Supplementary…, most of the incorrect classified pictures were classified as section *Paphiopedilum*. One explanation for this mistake could be that the species in both sections share several similar characteristics. The petals for instance have mostly the same shape. Although the colour is not always the same in both sections, some species from different sections have the same petal colour.

### Section *Brachypetalum*

This section is characterized morphologically by… The visual recognition software developed during this internship identified this section very well. None of the pictures were classified incorrectly and only a few were classified as unknown. But even then, most of the time the correct section was one of the options.

### Section *Coryopedilum*

This section is characterized morphologically by… In this section one picture stands out, *P. rothschildianium*1. This picture was classified correctly with all networks. So this is a good picture for classifying. Further, it is shown that the other two pictures of this section were much harder to identify. Possible explanations. are…

### Section *Barbata*

This section is characterized morphologically by… After characteristic pictures of three different species of the section *Barbata* were added to the test set, belonging to *P.* *argus, P. tonsum* and *P.* *wardii*, it turned out that even pictures with all characteristics of the section clearly visible were hard to classify correctly. Possible explanations. are…

### Section *Parvisepalum*

This section is characterized morphologically by… This section also has a striking picture, *P. emersoni*i2\_1. This picture is always incorrectly classified. Research on this picture shows the petals are darker than the petals on the other pictures. In addition, the table shows that *armeniacum* is the best species. All test pictures of this species are classified correct by all networks.

### Hybrids of species from sections *Parvisepalum* and *Brachypetalum*

Besides testing the ANNs with pictures of the sections, the networks were also tested with pictures of hybrids. This was done to… please explain further… The table shows that most of the time the pictures were classified as one of the parental sections. In just one case, *armeniacum*X*concolor* using the network with Desired Error 0,00001, both parental sections are found.

## Characteristic research

Following the results of the first run, research on the characteristics of some species was done. The results of this research can be found in supplementary 3. These results explain in large part why some species were classified very badly. Essential characters necessary for correct identification turned out to be…

During this research it was also discovered that some species of the sections *Barbata* and *Coryopedilum* had only one picture in the train data. This could also be a reason why these species were classified badly. Extra pictures of these species were added to the train data. This expanded train set was used to train the ANNs again. These new networks were tested again with the same test sets to find out if better classification results were obtained. The results of this experiment are described in more detail below.

## Second test run

To proof that more pictures in the train data improves the ability of the ANN’s to classify pictures, a second test run was done. The results of this run can be found in supplementary 2. The structure of these tables is the same as in supplementary 1. Most of the pictures (i.e. … out of …) were indeed classified better, showing that more training pays of. Some pictures were classified worse than in the first test run. This can be explained as follows. The first cause could be mere chance. When you train two networks with the same settings and the same train set, both networks will be different nonetheless. Explain why these networks could produce different classifications…

A second possible cause could be that the added pictures made it clear the test pictures did not belong to a certain section, but not to which section the picture belonged. This would have addes more ambiguity.

### Section *Barbata*

After the second test, species belonging to section *Barbata*were still difficult to classify. The results do show that most of the pictures of this section were classified better, though (i.e. … out of …). It is striking that some pictures of species with additional pictures in the train set were classified worse, though. These concerned the species…

### Section *Brachypetalum*

*Brachypetalum* is one of the sections that did not get additional pictures in the train set. Nevertheless, there are some pictures that were better classified than before. These concerned pictures of… But also in this section there were some pictures that were classified worse. . These concerned pictures of…

### Section *Coryopedilum*

This is a notably section. This section has got additional pictures in the train data, but not of the sections in the test data. Nevertheless, the pictures were much better classified than in the first run. This is also the only section that has no longer incorrectly classified pictures. Still some pictures are classified unknown.

### Section *Parvisepalum*

After the first test run this section was one of the best-classified sections. Although there were no additional pictures of this section, some pictures were classified well during the second test run.

### Hybrids of *Parvisepalum* and *Brachypetalum*

Most of the hybrids were classified correct in the first test run. During the second test run it was seen that some pictures were classified better to one of the parental sections. The picture that was classified to both parental sections in the first run, is classified to only one parental section in this run.

# Discussion

## Tubers

Because it is hard to extract DNA from a dried tuber, most of the tubers of confiscated salep orchids could not be identified to species level during my internship. During this project they could therefore only be used to train the neural network to see differences between orchid tubers and Look-a-Like tubers up to the generic level. The time necessary to test this was lacking, though, so this is not worked out completely. A new student will use the pictures that were made to further train the neural network to identify them to orchid versus look-a-likes.

## Slipper orchids

Sections of slipper orchids that could be identified correctly included… Sections that were less easy to identify were…. Main characters differing between both sections were… These characters were often not well displayed on pictures, which might explain…

## Training networks

While training the networks it was found that it is very hard to find good pictures of flowers of some species. When this fact is combined with the fact that some species had few pictures in the train set only, this could be a reason why these species were badly classified. This assumption is supported by the fact that when more pictures were added to the train set, identification improved. This was especially found for P…. list species names.

# Conclusions

## Classifying slipper orchids from pictures is possible

Although some species are very hard to classify, the results show that it is possible for some species to be classified to section level using a picture. Some species need more and/or better pictures in the train set, but the concept of classifying slipper orchids from a picture has been proven during this project.

## Difference between well classifiable vs non classifiable sections of slipper orchids

Write something here about sections for which correct classification improved after more pictures were added during training and for which sections this did not happen. Which characters were responsible?

# Acknowledgements

I would like to thank the following people for helping me… please add

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# Supplementaries

## Results of first test run

Table 2 Results of first test of *Paphiopedilum* section *Barbata*. Red: incorrectly classified. Green: Correctly classified. Yellow background and brown text: Unable to classify (to one section). Yellow background and green text: Unable to classify to one section, but the correct one is in the options.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | ***Paphiopedilum* sect. *Barbata* run1** | |  |  |  |
|  |  |  |  |  |  |  |  |
| **ANN** | **41** | **42** | **43** | **44** | **45** | **46** | **47** |
| **Desired Error** | 1,00E-04 | 1,00E-05 | 1,00E-06 | 1,00E-07 | 1,00E-08 | 1,00E-09 | 1,00E-10 |
| **Time to classify (s)** | 16 | 15 | 15 | 15 | 14 | 15 | 14 |
| **Pictures** |  |  |  |  |  |  |  |
| acmodontum1 | Incorrect 1 | Incorrect 1 | Unknown 7/1 | Incorrect 1 | Incorrect 1 | Incorrect 1 | Incorrect 1 |
| appletonianum1 | Incorrect 3 | Unknown | Incorrect 3 | Incorrect 3 | Incorrect 3 | Incorrect 6 | Incorrect 6 |
| argus1 | Unknown 7/3 | Unknown | Correct | Unknown 7/3 | Unknown 7/3 | Correct | Unknown 3/7 |
| argus2\_2 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| barbatum1 | Incorrect 1 (low) | Unknown 7/3 | Unknown 3/1(low) | Incorrect 3 | Unknown 7/3 | Incorrect 3 | Unknown |
| barbatum2\_2 | Incorrect 3 | Incorrect 3(low) | Unknown | Unknown | Incorrect 3 | Unknown | Incorrect 3 |
| bougainvilleanum1\* | Unknown 7/1(low) | Incorrect 3 | Unknown | Incorrect 3 | Incorrect 3 | Incorrect 3 | Incorrect 3 |
| bullenianum1 | Unknown 3/1(low) | Incorrect 3 | Incorrect 1 | Unknown 1/3 | Incorrect 3 | Incorrect 1 | Unknown |
| callosum1 | Incorrect 6 | Unknown 6/3(low) | Unknown | Incorrect 1(low) | Incorrect 1 | Incorrect 6 | Incorrect 6 |
| callosum2 | Incorrect 3 | Incorrect 3 | Incorrect 3 | Incorrect 3 | Incorrect 1 | Unknown | Incorrect 3 |
| callosum3 | Unknown | Incorrect 3 | Incorrect 2 | Unknown | Incorrect 3 | Unknown | Correct |
| dayanum1 | Unknown | Unknown | Unknown | Unknown | Correct | Incorrect 6 | Unknown |
| dayanum2\_3 | Unknown 7/2 | Correct | Unknown 7/3 | Unknown | Incorrect 6 | Correct | Unknown |
| dayanum2 | Incorrect 3 | Incorrect 3 | Unknown | Unknown 3/1(low) | Unknown | Incorrect 1 | Unknown |
| fowliei1\* | Incorrect 3 | Incorrect 3 | Incorrect 3 | Incorrect 3 | Unknown | Correct | Correct |
| fowliei2\* | Unknown | Incorrect 3 | Incorrect 3 | Incorrect 3 | Incorrect 3 | Incorrect 3 | Incorrect 3 |
| hennisianum1 | Unknown 3/1 | Incorrect 1 | Incorrect 3 | Incorrect 1 | Incorrect 1 | Incorrect 3 | Unknown 1/7 |
| hennisianum2\_1 | Unknown 3/7(low) | Incorrect 3 | Correct | Unknown 7/3(low) | Unknown 7/3 | Correct | Unknown |
| hennisianum2 | Incorrect 3 | Correct(low) | Incorrect 3 | Unknown | Incorrect 3 | Incorrect 5 | Unknown |
| hookerae1 | Incorrect 3 | Incorrect 3 | Incorrect 3 | Incorrect 3 | Incorrect 3(low) | Incorrect 3 | Incorrect 3 |
| hookerae2\_4 | Correct | Correct | Incorrect 3 | Correct | Correct | Correct | Correct |
| javanicum1\* | Correct | Correct | Correct | Unknown 1/2/7(low) | Correct | Correct | Correct |
| javanicum2\* | Unknown 7/1 | Unknown | Unknown 7/1 | Incorrect 1 | Unknown | Correct | Unknown |
| lawrenceanum1 | Correct | Unknown | Unknown | Incorrect 5 | Unknown | Unknown | Unknown |
| mastersianum1 | Incorrect 3 | Incorrect 3 | Unknown 3/1(low) | Incorrect 3 | Incorrect 3 | Unknown 3/7 | Correct |
| mastersianum2\_5 | Correct | Correct | Correct | Correct | Correct | Correct | Incorrect 5 |
| papuanum1\* | Correct | Incorrect 1 | Incorrect 1 | Incorrect 1 | Correct | Unknown | Correct |
| purpuratum1 | Incorrect 1 | Incorrect 1 | Incorrect 6 | Incorrect 1 | Unknown 1/3 | Incorrect 1(low) | Unknown 1/3 |
| purpuratum2\_1 | Unknown 7/3 | Correct | Unknown 3/7 | Correct | Correct | Unknown 7/3 | Correct |
| purpuratum2 | Incorrect 1 | Incorrect 1 | Unknown 1/7 | Incorrect 1 | Incorrect 1 | Incorrect 1 | Unknown 1/7 |
| schoseri1\* | Incorrect 1 | Unknown | Unknown | Unknown | Unknown | Incorrect 6(low) | Unknown |
| sukhakulii1 | Incorrect 1 | Unknown | Incorrect 1 | Correct | Unknown | Incorrect 3 | Unknown |
| superbiens1§ | Unknown 3/7 | Correct | Incorrect 3 | Correct | Incorrect 3(low) | Unknown 7/3 | Incorrect 3 |
| tonsum1 | Correct | Unknown 7/1 | Correct | Correct | Incorrect 1 | Correct | Correct |
| tonsum2\_2 | Correct | Correct | Correct | Correct | Unknown | Incorrect 3 | Incorrect 3 |
| tonsum2 | Correct | Correct | Unknown 3/7 | Correct | Unknown | Correct | Incorrect 3 |
| tonsum3 | Correct | Correct | Unknown | Unknown | Unknown | Correct | Unknown |
| urbanianum1 | Incorrect 3 | Incorrect 3 | Incorrect 3 | Incorrect 3(low) | Unknown 1/7 | Correct | Unknown 3/7 |
| urbanianum2\_3 | Unknown | Correct | Correct | Unknown | Correct | Correct | Unknown |
| violascens1 | Incorrect 1 | Unknown 7/1 | Incorrect 3 | Correct | Incorrect 3 | Incorrect 3 | Unknown 3/1 |
| violascens2 | Unknown | Incorrect 3 | Incorrect 3 | Incorrect 3 | Incorrect 3 | Unknown 3/7 | Incorrect 3 |
| wardii1 | Incorrect 1 (low) | Unknown 3/1 | Unknown 7/1 | Incorrect 1 | Incorrect 1 | Incorrect 1 | Unknown |
| wardii2\_1 | Correct | Correct | Unknown 7/1 | Correct | Unknown 5/1 | Unknown 7/5 | Incorrect 5 |
| wentworthianum1\* | Incorrect 1 | Unknown | Incorrect 4 | Incorrect 1 | Incorrect 1 | Incorrect 1(low) | Unknown |
| wentworthianum2\* | Unknown | Incorrect 3 | Incorrect 4 | Unknown | Unknown | Unknown | Unknown |
| **Pictures** | **41** | **42** | **43** | **44** | **45** | **46** | **47** |
|  |  |  |  |  |  |  |  |
|  |  |  | 1:*Parvisepalum* | 2:*Pardalopetalum* | 3:*Paphiopedilum* | 4:*Coryopedilum* | 5: *Cochlopetalum* |
|  | \*= not in train set / on dear.smartweb.tw | | 6:*Brachypetalum* | 7:*Barbata* |  |  |  |
|  | §=only var. Curtisii in train set | | The order in Unknown x/y is <best\_sore>/<lower\_score>. No numbers? All scores are negative | | | | |

Table 3 Results of first test of extra pictures of *Paphiopedilum* section *Barbata*. Red: incorrect classified. Green: Correct classified. Yellow background and brown text: Unable to classify (to one section). Yellow background and green text: Unable to classify to one section, but the correct one is in the options.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | ***Paphiopedilum* sect. *Barbata* run2** | |  |  |  |
|  |  |  |  |  |  |  |  |
| **ANN** | **41** | **42** | **43** | **44** | **45** | **46** | **47** |
| **Desired Error** | 1,00E-04 | 1,00E-05 | 1,00E-06 | 1,00E-07 | 1,00E-08 | 1,00E-09 | 1,00E-10 |
| **Time to classify (s)** | 2 | 2 | 2 | 2 | 2 | 1 | 2 |
| **Picture** |  |  |  |  |  |  |  |
| paph\_argus | Correct | Unknown | Correct | Unknown 2/7 | Correct | Correct | Correct |
| Paptonsum\_blaine | Correct | Unknown | Unknown | Correct | Unknown | Unknown | Unknown |
| Paphtonsum\_elle | Unknown | Incorrect 1 | Incorrect 3 | Unknown | Incorrect 3 | Incorrect 1 | Unknown |
| Paphwardii | Incorrect 3 | Incorrect 3 | Correct | Incorrect 3 | Incorrect 3 | Incorrect 3 | Unknown |
|  |  |  |  |  |  |  |  |
|  |  |  | Legend Incorrect/Unknown | | |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  | 1 | *Parvisepalum* | 2 | *Pardalopetalum* |
|  |  |  |  | 3 | *Paphiopedilum* | 4 | *Coryopedilum* |
|  |  |  |  | 5 | *Cochlopetalum* | 6 | *Brachypetalum* |
|  |  |  |  | 7 | *Barbata* |  |  |
|  |  |  | The order in Unknown x/y is <best\_score>/<lower\_score>. No numbers? All scores are negative! | | | | |

Table 4 Results of first test of *Paphiopedilum* section *Brachypetalum.* Red: incorrect classified. Green: Correct classified. Yellow background and brown text: Unable to classify (to one section). Yellow background and green text: Unable to classify to one section, but the correct one is in the options.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | ***Paphiopedilum* sect. *Brachypetalum* run1** | |  |  |  |
|  |  |  |  |  |  |  |  |
| **ANN** | **41** | **42** | **43** | **44** | **45** | **46** | **47** |
| **Desired Error** | 1,00E-04 | 1,00E-05 | 1,00E-06 | 1,00E-07 | 1,00E-08 | 1,00E-09 | 1,00E-10 |
| **Time to classify (s)** | 8 | 7 | 7 | 7 | 7 | 7 | 8 |
| **Pictures** |  |  |  |  |  |  |  |
| bellatum1 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| concolor1 | Correct | Unknown 6/1 | Correct | Correct | Unknown | Correct | Correct |
| concolor2\_2 | Correct | Correct | Unknown 6/1 | Correct | Unknown 6/1 | Correct | Correct |
| concolor2\_4 | Correct | Correct | Correct | Correct | Correct | Unknown 6/3 | Correct |
| concolor2\_6 | Correct | Unknown 6/1 | Unknown 6/1(low) | Correct | Unknown 6/1 | Correct | Correct |
| concolor2 | Correct | Correct | Correct | Correct | Unknown 6/3 | Unknown | Correct |
| godefroyae1 | Unknown 6/1(low) | Unknown | Unknown 6/7 | Unknown 6/1 | Unknown 7/6 | Correct | Correct |
| godefroyae2\_11 | Unknown 6/3 | Correct | Unknown 6/3 | Correct | Correct | Correct | Correct |
| godefroyae2\_13 | Correct | Unknown | Unknown 1/3 | Correct | Correct | Correct | Correct(low) |
| godefroyae2\_15 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| godefroyae2\_1 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| godefroyae2\_3 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| godefroyae2\_5 | Correct | Correct | Correct | Correct | Correct | Correct | Unknown 6/3 |
| godefroyae2\_7 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| godefroyae2\_9 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| godefroyae2 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| niveum1 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| niveum2\_4 | Unknown 6/2(low) | Correct | Correct | Correct | Correct | Correct | Correct |
| niveum2\_5 | Correct | Correct | Correct | Correct | Correct | Unknown | Correct |
| niveum2\_7 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
|  |  |  | 1:*Parvisepalum* | 2:*Pardalopetalum* | 3:*Paphiopedilum* | 4:*Coryopedilum* | 5: *Cochlopetalum* |
|  |  |  | 6:*Brachypetalum* | 7:*Barbata* |  |  |  |
|  |  |  | The order in Unknown x/y is <best\_score>/<lower\_score>. No numbers? All scores are negative! | | | | |

Table 5 Results of first test of *Paphiopedilum* section *Coryopedilum*. Red: incorrect classified. Green: Correct classified. Yellow background and brown text: Unable to classify (to one section). Yellow background and green text: Unable to classify to one section, but the correct one is in the options.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | ***Paphiopedilum* sect. *Coryopedilum* run1** | |  |  |  |
|  |  |  |  |  |  |  |  |
| **ANN** | **41** | **42** | **43** | **44** | **45** | **46** | **47** |
| **Desired Error** | 1,00E-04 | 1,00E-05 | 1,00E-06 | 1,00E-07 | 1,00E-08 | 1,00E-09 | 1,00E-10 |
| **Time to classify (s)** | 4 | 3 | 3 | 3 | 3 | 3 | 3 |
| **Pictures** |  |  |  |  |  |  |  |
| glanduliferum3 | Incorrect 3 | Unknown | Unknown | Incorrect 3 | Incorrect 3 | Unknown | Unknown |
| rothschildianium1 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| wilhelminiae1 | Unknown | Unknown 4/3 | Unknown | Unknown | Correct | Correct | Correct |
| philippinense1 | Correct | Correct | Unknown | Incorrect 1 | Unknown | Unknown | Unknown |
| rothschildianium2 | Unknown 4/5 | Unknown | Incorrect 1 | Correct | Correct | Correct | Correct |
| rothschildianium3 | Correct | Correct | Incorrect 1(low) | Incorrect 1(low) | Unknown | Unknown 3/4 | Correct |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  | Legend Incorrect/Unknown | |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  | 1 | *Parvisepalum* | 2 | *Pardalopetalum* |
|  |  |  |  | 3 | *Paphiopedilum* | 4 | *Coryopedilum* |
|  |  |  |  | 5 | *Cochlopetalum* | 6 | *Brachypetalum* |
|  |  |  |  | 7 | *Barbata* |  |  |

Table 6 Results of first test of *Paphiopedilum* section *Parvisepalum*. Red: incorrect classified. Green: Correct classified. Yellow background and brown text: Unable to classify (to one section). Yellow background and green text: Unable to classify to one section, but the correct one is in the options.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | ***Paphiopedilum* sect. *Parvisepalum* run1** | |  |  |  |
|  |  |  |  |  |  |  |  |
| **ANN** | **41** | **42** | **43** | **44** | **45** | **46** | **47** |
| **Desired Error** | 1,00E-04 | 1,00E-05 | 1,00E-06 | 1,00E-07 | 1,00E-08 | 1,00E-09 | 1,00E-10 |
| **Time to classify (s)** | 15 | 15 | 15 | 15 | 14 | 15 | 15 |
| **Pictures** |  |  |  |  |  |  |  |
| armeniacum1 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| armeniacum2\_4 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| armeniacum2\_5 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| armeniacum2\_6 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| armeniacum2\_7 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| armeniacum2\_8 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| delenatii1 | Correct | Unknown | Unknown | Unknown | Correct | Correct | Correct(low) |
| delenatii2\_2 | Correct | Correct(low) | Correct | Correct | Correct | Correct | Unknown 1/7 |
| delenatii2\_4 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| delenatii2\_6 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| delenatii2 | Correct | Correct | Correct | Correct | Unknown 7/1 | Correct | Correct |
| emersonii1 | Unknown 3/1 | Unknown | Correct | Incorrect 3(low) | Correct | Correct | Unknown |
| emersonii2\_1 | Incorrect 3 | Incorrect 3 | Incorrect 3 | Incorrect 3 | Incorrect 3 | Unknown | Incorrect 3 |
| emersonii2\_3 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| emersonii2\_5 | Correct | Correct | Unknown 1/3 | Correct(low) | Correct | Correct | Correct |
| malipoense1 | Correct | Correct | Unknown 3/1 | Unknown | Incorrect 3(low) | Correct | Incorrect 3 |
| malipoense2\_10 | Correct | Correct | Correct | Correct | Unknown 1/7 | Correct | Correct |
| malipoense2\_12 | Correct | Correct | Unknown 3/1 | Correct | Correct | Correct | Correct |
| malipoense2\_14 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| malipoense2\_16 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| malipoense2\_18 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| malipoense2\_2 | Correct | Correct | Correct | Correct | Correct | Unknown 1/3 | Correct |
| malipoense2\_4 | Unknown 1/7 | Correct | Correct | Correct | Correct | Correct | Correct |
| malipoense2\_6 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| malipoense2\_8 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| malipoense2 | Unknown | Unknown | Unknown | Correct | Correct | Unknown | Correct |
| malipoense3 | Correct | Unknown | Incorrect 7 | Unknown | Correct | Unknown | Correct |
| micranthum1 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| micranthum2\_11 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| micranthum2\_13 | Correct | Correct | Unknown | Correct | Correct | Unknown | Correct |
| micranthum2\_15 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| micranthum2\_17 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| micranthum2\_19 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| micranthum2\_1 | Correct | Correct | Correct | Correct | Correct | Correct | Correct(low) |
| micranthum2\_21 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| micranthum2\_3 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| micranthum2\_5 | Correct | Correct | Incorrect 3 | Correct | Incorrect 3 | Unknown | Unknown |
| micranthum2\_7 | Correct (very low) | Correct | Unknown 7/1(low) | Correct | Incorrect 7 | Incorrect 5 | Unknown |
| micranthum2\_9 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| micranthum2 | Correct | Unknown 1/6 | Correct | Correct | Correct | Correct | Correct |
| micranthum3 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| **Picture** | **41** | **42** | **43** | **44** | **45** | **46** | **47** |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  | 1:*Parvisepalum* | 2:*Pardalopetalum* | 3:*Paphiopedilum* | 4:*Coryopedilum* | 5: *Cochlopetalum* |
|  |  |  | 6:*Brachypetalum* | 7:*Barbata* |  |  |  |
|  |  |  | The order in Un-known x/y is <best\_sore>/<lower\_score>. No numbers? All scores are negative | | | | |

Table 7 Results of first test of hybrids of *Paphiopedilum* sect. *Parvisepalum* and *Brachypetalum*. Red: incorrect classified. Green: Correct classification to one of the parental sections. Green and bold: Correct classification to both parental sections. Yellow background and brown text: Unable to classify.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | ***Paphiopedilum* sect. *Parvisepalum* X *Brachypetalum* run1** | | | |  |  |
|  |  |  |  |  |  |  |  |
| **ANN** | **41** | **42** | **43** | **44** | **45** | **46** | **47** |
| **Desired Error** | 1,00E-04 | 1,00E-05 | 1,00E-06 | 1,00E-07 | 1,00E-08 | 1,00E-09 | 1,00E-10 |
| **Time to classify (s)** | 7 | 5 | 5 | 5 | 5 | 4 | 5 |
| **Pictures** |  |  |  |  |  |  |  |
| armeniacumXconcolor2 | Unknown | 1 | 1 | 1 | 1 | 1 | 1 |
| delenatiiXniveum2 | 1 | Unknown | Unknown | 6 | Unknown | 1 | Unknown |
| armeniacumXconcolor1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| armeniacumXconcolor6 | 6 | ***1&6*** | 1 | 1 | 1 | 1 | 1 |
| emersoniiXbellatulum | 3&1 | 1 | 1&7 | Unknown | Unknown | 3 | 1 |
| delenatiiXniveum1 | 6 | 6 | 6 | Unknown | 6(low) | 6 | 6 |
| armeniacumXconcolor5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| armeniacumXconcolor4 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  | Legend |  |  |  |  |
|  |  |  |  | 1 | *Parvisepalum* | 2 | *Pardalopetalum* |
|  |  |  |  | 3 | *Paphiopedilum* | 4 | *Coryopedilum* |
|  |  |  |  | 5 | *Cochlopetalum* | 6 | *Brachypetalum* |
|  |  |  |  | 7 | *Barbata* |  |  |

## Results of second test run

Table 8 Results of second test run of *Paphiopedilum* section *Barbata*. Red: incorrect classified. Green: Correct classified. Yellow background and brown text: Unable to classify (to one section). Yellow background and green text: Unable to classify to one section, but the correct one is in the options.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | ***Paphiopedilum* sect. *Barbata* run2** | |  |  |  |
|  |  |  |  |  |  |  |  |
| **ANN** | **51** | **52** | **53** | **54** | **55** | **56** | **57** |
| **Desired Error** | 1,00E-04 | 1,00E-05 | 1,00E-06 | 1,00E-07 | 1,00E-08 | 1,00E-09 | 1,00E-10 |
| **Time to classify (s)** | 17 | 15 | 14 | 15 | 16 | 14 | 14 |
| **Pictures** |  |  |  |  |  |  |  |
| acmodontum1 | Unknown 1/2 | Incorrect 1 | Incorrect 1 | Incorrect 1 | Unknown 7/1 | Incorrect 1 | Incorrect 1 |
| appletonianum1 | Incorrect 1 | Unknown | Incorrect 3(low) | Incorrect 6 | Unknown | Unknown | Incorrect 1 |
| argus1 | Unknown 7/3 | Correct | Correct | Unknown | Incorrect 3 | Correct | Unknown 7/3 |
| argus2\_2 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| barbatum1 | Unknown | Unknown | Incorrect 3 | Incorrect 3 | Incorrect 1 | Unknown 3/7 | Incorrect 3 |
| barbatum2\_2 | Unknown | Incorrect 5 | Unknown 7/3(low) | Unknown | Incorrect 4 | Incorrect 5 | Unknown |
| bougainvilleanum1\* | Unknown 7/3 | Incorrect 3 | Correct | Correct | Unknown 3/7 | Unknown 7/3 | Unknown 7/3 |
| bullenianum1 | Incorrect 1 | Incorrect 1(low) | Unknown | Unknown | Incorrect 1 | Incorrect 3 | Unknown |
| callosum1 | Unknown 6/3 | Incorrect 3 | Incorrect 6 | Unknown 3/6 | Incorrect 6 | Incorrect 6 | Unknown |
| callosum2 | Incorrect 3 | Incorrect 3 | Incorrect 3 | Incorrect 3 | Incorrect 3 | Incorrect 3 | Incorrect 3 |
| callosum3 | Correct | Unknown | Unknown | Correct | Correct | Correct | Correct |
| dayanum1 | Unknown | Unknown | Unknown | Unknown | Incorrect 6 | Incorrect 6(low) | Unknown |
| dayanum2\_3 | Incorrect 4(low) | Unknown 1/7 | Unknown | Unknown | Unknown | Unknown 4/7 | Unknown |
| dayanum2 | Incorrect 3(low) | Incorrect 3 | Unknown 5/4 | Unknown | Unknown | Unknown | Incorrect 5 |
| fowliei1\* | Unknown low:3/7 | Unknown 3/7(low) | Correct | Incorrect 3 | Incorrect 3(low) | Incorrect 3 | Unknown |
| fowliei2\* | Incorrect 3 | Incorrect 3 | Incorrect 3(low) | Unknown | Incorrect 3 | Incorrect 3(low) | Incorrect 3 |
| hennisianum1 | Unknown | Incorrect 1(low) | Unknown | Unknown | Incorrect 1 | Incorrect 1 | Incorrect 1 |
| hennisianum2\_1 | Correct | Incorrect 3 | Correct | Correct | Unknown 7/3 | Correct | Correct |
| hennisianum2 | Incorrect 3(low) | Unknown | Unknown | Unknown | Unknown | Unknown | Incorrect 3 |
| hookerae1 | Incorrect 3 | Incorrect 3 | Unknown 3/7 | Incorrect 3 | Incorrect 3 | Unknown | Incorrect 3 |
| hookerae2\_4 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| javanicum1\* | Correct | Correct | Correct | Correct | Correct | Unknown 7/3 | Correct |
| javanicum2\* | Unknown | Incorrect 1 | Correct | Correct(low) | Unknown 7/1 | Unknown 7/1 | Incorrect 1(low) |
| lawrenceanum1 | Incorrect 4 | Unknown | Correct | Unknown | Unknown | Unknown | Unknown |
| mastersianum1 | Unknown | Correct | Unknown 7/3(low) | Correct | Correct | Correct | Correct(low) |
| mastersianum2\_5 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| papuanum1\* | Unknown 4/7/1(L) | Unknown | Unknown 7/6/1 | Unknown | Correct | Unknown 3/7(low) | Incorrect 5 |
| purpuratum1 | Incorrect 1 | Incorrect 1 | Incorrect 1 | Unknown 1/3(low) | Unknown | Incorrect 1 | Incorrect 1 |
| purpuratum2\_1 | Unknown 7/3 | Unknown 7/5 | Correct | Correct | Correct | Correct | Correct |
| purpuratum2 | Incorrect 1 | Unknown 7/1 | Unknown 1/7 | Unknown 1/7 | Unknown 7/1 | Incorrect 1 | Incorrect 1 |
| schoseri1\* | Unknown | Unknown | Unknown | Unknown | Incorrect 6 | Unknown | Incorrect 1 |
| sukhakulii1 | Incorrect 1 | Unknown 1/7(low) | Incorrect 3 | Incorrect 1 | Incorrect 4 | Incorrect 1 | Unknown |
| superbiens1§ | Unknown | Unknown 7/3 | Correct | Correct(low) | Unknown 3/7(L) | Unknown | Correct |
| tonsum1 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| tonsum2\_2 | Correct | Correct | Incorrect 5 | Correct | Correct | Correct | Correct |
| tonsum2 | Unknown | Correct | Correct | Unknown | Correct | Correct | Correct |
| tonsum3 | Correct | Incorrect 3 | Correct | Correct | Unknown | Incorrect 3 | Unknown |
| urbanianum1 | Correct | Unknown 7/1(low) | Incorrect 3 | Unknown | Unknown | Unknown | Incorrect 3(low) |
| urbanianum2\_3 | Correct(low) | Correct | Correct | Correct(low) | Correct | Correct(low) | Correct |
| violascens1 | Unknown 3/7(low) | Incorrect 3 | Incorrect 3 | Unknown | Correct(low) | Unknown | Incorrect 3 |
| violascens2 | Unknown 7/3 | Incorrect 3(low) | Incorrect 3(low) | Correct | Unknown 3/7 | Unknown | Incorrect 3 |
| wardii1 | Incorrect 1 | Unknown 1/3(low) | Incorrect 1 | Incorrect 1 | Unknown 3/1 | Incorrect 1 | Unknown |
| wardii2\_1 | Correct | Correct | Correct | Correct | Correct | Correct | Unknown 1/7(low) |
| wentworthianum1\* | Correct | Unknown | Unknown | Correct(low) | Unknown | Unknown | Unknown |
| wentworthianum2\* | Unknown | Unknown | Correct | Unknown | Unknown | Unknown | Unknown |
| **Pictures** | **51** | **52** | **53** | **54** | **55** | **56** | **57** |
|  |  |  |  |  |  |  |  |
|  |  |  | 1:*Parvisepalum* | 2:*Pardalopetalum* | 3:*Paphiopedilum* | 4:*Coryopedilum* | 5: *Cochlopetalum* |
|  | \*= not in train set / on dear.smartweb.tw | | 6:*Brachypetalum* | 7:*Barbata* | L:low |  |  |
|  | §= only var. Curtisii in train set. | | The order in Unknown x/y is <best\_sore>/<lower\_score>. No numbers? All scores are negative | | | | |

Table 9 Results of second test of the extra pictures of *Paphiopedilum* section *Barbata*. Red: incorrect classified. Green: Correct classified. Yellow background and brown text: Unable to classify (to one section). Yellow background and green text: Unable to classify to one section, but the correct one is in the options.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | ***Paphiopedilum* sect. *Barbata* run2** | |  |  |  |
|  |  |  |  |  |  |  |  |
| **ANN** | **51** | **52** | **53** | **54** | **55** | **56** | **57** |
| **Desired Error** | 1,00E-04 | 1,00E-05 | 1,00E-06 | 1,00E-07 | 1,00E-08 | 1,00E-09 | 1,00E-10 |
| **Time to classify (s)** | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
|  |  |  |  |  |  |  |  |
| paph\_argus | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| Paptonsum\_blaine | Incorrect 1(low) | Unknown | Unknown | Correct(low) | Correct | Correct | Correct |
| Paphtonsum\_elle | Incorrect 1 | Incorrect 3(low) | Unknown | Unknown | Unknown | Incorrect 1 | Incorrect 1(low) |
| Paphwardii | Incorrect 3 | Incorrect 3 | Unknown 3/6 | Incorrect 3 | Unknown 3/7 | Unknown | Incorrect 3 |
|  |  |  |  |  |  |  |  |
|  |  |  | Legend Incorrect/Unknown | |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  | 1 | *Parvisepalum* | 2 | *Pardalopetalum* |
|  |  |  |  | 3 | *Paphiopedilum* | 4 | *Coryopedilum* |
|  |  |  |  | 5 | *Cochlopetalum* | 6 | *Brachypetalum* |
|  |  |  |  | 7 | *Barbata* |  |  |
|  |  |  | The order in Unknown x/y is <best\_score>/<lower\_score>/ No numbers? All scores are negative | | | | |

Table 10 Results of second test run of *Paphiopedilum* section *Brachypetalum*. Red: incorrect classified. Green: Correct classified. Yellow background and brown text: Unable to classify (to one section). Yellow background and green text: Unable to classify to one section, but the correct one is in the options.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | ***Paphiopedilum* sect. *Brachypetalum* run2** | | |  |  |  |
|  |  |  |  |  |  |  |  |
| **ANN** | **51** | **52** | **53** | **54** | **55** | **56** | **57** |
| **Desired Error** | 1,00E-04 | 1,00E-05 | 1,00E-06 | 1,00E-07 | 1,00E-08 | 1,00E-09 | 1,00E-10 |
| **Time to classify (s)** | 7 | 7 | 8 | 7 | 7 | 6 | 7 |
| **Pictures** |  |  |  |  |  |  |  |
| bellatum1 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| concolor1 | Correct | Correct | Correct | Unknown | Correct | Correct | Correct |
| concolor2\_2 | Correct | Unknown 6/1 | Unknown 6/1 | Correct | Unknown 6/1 | Unknown 6/1 | Correct |
| concolor2\_4 | Correct | Correct | Unknown 6/1 | Unknown 6/1 | Correct | Unknown 6/1 | Correct |
| concolor2\_6 | Correct | Correct | Unknown 6/1 | Correct | Unknown 6/1 | Unknown 6/1 | Correct |
| concolor2 | Correct | Correct | Correct | Correct | Unknown | Correct | Correct |
| godefroyae1 | Unknown | Unknown | Unknown 6/7 | Correct | Unknown 6/1 | Incorrect 1 | Incorrect 1 |
| godefroyae2\_11 | Correct | Unknown | Correct | Correct | Correct | Correct | Correct |
| godefroyae2\_13 | Correct | Unknown | Correct | Correct | Correct | Correct | Correct |
| godefroyae2\_15 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| godefroyae2\_1 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| godefroyae2\_3 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| godefroyae2\_5 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| godefroyae2\_7 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| godefroyae2\_9 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| godefroyae2 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| niveum1 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| niveum2\_4 | Unknown | Correct | Correct | Correct | Correct | Unknown 6/1 | Correct |
| niveum2\_5 | Correct | Correct | Unknown 6/3(low) | Unknown | Correct | Correct | Correct |
| niveum2\_7 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
|  |  |  |  | 1:Parvisepalum | 2:Pardalopetalum | 3:Paphiopedilum | 4:Coryopedilum |
|  |  |  |  | 5: Cochlopetalum | 6: Brachypetalum | 7:Barbata |  |
|  |  |  |  | The order in Unknown x/y is <best\_sore>/<lower\_score>. No numbers? All scores are negative! | | | |

Table 11 Results of second test of *Paphiopedilum* section *Coryopedilum*. Red: incorrect classified. Green: Correct classified. Yellow background and brown text: Unable to classify (to one section). Yellow background and green text: Unable to classify to one section, but the correct one is in the options.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | ***Paphiopedilum* sect. *Coryopedilum* run2** | |  |  |  |
|  |  |  |  |  |  |  |  |
| **ANN** | **51** | **52** | **53** | **54** | **55** | **56** | **57** |
| **Desired Error** | 1,00E-04 | 1,00E-05 | 1,00E-06 | 1,00E-07 | 1,00E-08 | 1,00E-09 | 1,00E-10 |
| **Time to classify (s)** | 3 | 3 | 3 | 2 | 2 | 3 | 2 |
| **Picture** |  |  |  |  |  |  |  |
| glanduliferum3 | Correct | Correct | Unknown | Correct | Unknown 4/3 | Unknown | Correct |
| rothschildianium1 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| wilhelminiae1 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| philippinense1 | Correct | Unknown 4/1 | Correct | Correct | Unknown 4/6 | Correct | Correct |
| rothschildianium2 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| rothschildianium3 | Correct | Correct | Correct | Unknown | Correct | Correct | Correct |
|  |  |  |  |  |  |  |  |
|  |  |  | Legend Incorrect/Unknown | |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  | 1 | *Parvisepalum* | 2 | *Pardalopetalum* |
|  |  |  |  | 3 | *Paphiopedilum* | 4 | *Coryopedilum* |
|  |  |  |  | 5 | *Cochlopetalum* | 6 | *Brachypetalum* |
|  |  |  |  | 7 | *Barbata* |  |  |
|  |  |  | The order in Unknown x/y is <best\_score>/<lower\_score>/ No numbers? All scores are negative | | | | |

Table 12 Results of second test of *Paphiopedilum* section *Parvisepalum*. Red: incorrect classified. Green: Correct classified. Yellow background and brown text: Unable to classify (to one section). Yellow background and green text: Unable to classify to one section, but the correct one is in the options.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | ***Paphiopedilum* sect. *Parvisepalum* run2** | |  |  |  |
|  |  |  |  |  |  |  |  |
| **ANN** | **51** | **52** | **53** | **54** | **55** | **56** | **57** |
| **Desired Error** | 1,00E-04 | 1,00E-05 | 1,00E-06 | 1,00E-07 | 1,00E-08 | 1,00E-09 | 1,00E-10 |
| **Time to classify (s)** | 15 | 14 | 14 | 14 | 15 | 14 | 14 |
| **Picture** |  |  |  |  |  |  |  |
| armeniacum1 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| armeniacum2\_4 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| armeniacum2\_5 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| armeniacum2\_6 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| armeniacum2\_7 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| armeniacum2\_8 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| delenatii1 | Unknown | Correct | Unknown | Correct | Correct | Correct | Unknown |
| delenatii2\_2 | Correct | Correct | Correct | Correct | Unknown | Correct | Unknown |
| delenatii2\_4 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| delenatii2\_6 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| delenatii2 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| emersonii1 | Unknown low:1/3 | Correct | Correct | Correct | Incorrect 3 | Incorrect 3 | Unknown |
| emersonii2\_1 | Incorrect 3 | Incorrect 3 | Incorrect 3 | Incorrect 3 | Incorrect 3 | Incorrect 3 | Incorrect 3 |
| emersonii2\_3 | Unknown 1/3(low) | Correct | Correct | Unknown | Unknown 3/1 | Unknown 1/3 | Correct |
| emersonii2\_5 | Unknown | Correct | Unknown | Unknown | Unknown | Unknown | Correct |
| malipoense1 | Correct | Unknown 1/3 | Unknown | Correct | Unknown 3/1(low) | Correct | Correct |
| malipoense2\_10 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| malipoense2\_12 | Correct | Correct | Correct | Correct | Incorrect 3 | Correct | Correct |
| malipoense2\_14 | Correct | Correct | Correct | Unknown | Correct | Correct | Correct |
| malipoense2\_16 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| malipoense2\_18 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| malipoense2\_2 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| malipoense2\_4 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| malipoense2\_6 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| malipoense2\_8 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| malipoense2 | Correct | Correct | Correct | Unknown | Correct | Correct | Correct |
| malipoense3 | Unknown | Unknown | Incorrect 7 | Unknown | Unknown | Incorrect 7 | Incorrect 7 |
| micranthum1 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| micranthum2\_11 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| micranthum2\_13 | Unknown | Unknown | Unknown | Correct | Unknown | Unknown | Unknown |
| micranthum2\_15 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| micranthum2\_17 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| micranthum2\_19 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| micranthum2\_1 | Correct(low) | Incorrect 5 | Incorrect 6 | Correct | Correct | Correct | Unknown |
| micranthum2\_21 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| micranthum2\_3 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| micranthum2\_5 | Unknown | Incorrect 7 | Unknown | Correct | Unknown | Unknown | Unknown 3/1 |
| micranthum2\_7 | Correct | Correct | Correct | Correct | Correct | Correct | Correct(low) |
| micranthum2\_9 | Correct | Correct | Correct | Correct | Correct | Correct | Correct |
| micranthum2 | Correct | Correct | Incorrect 4 | Correct | Unknown | Correct | Correct |
| micranthum3 | Correct | Correct | Unknown 1/4 | Correct | Correct | Correct | Correct |
| **Picture** | **51** | **52** | **53** | **54** | **55** | **56** | **57** |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  | 1:*Parvisepalum* | 2:*Pardalopetalum* | 3:*Paphiopedilum* | 4:*Coryopedilum* | 5: *Cochlopetalum* |
|  |  |  | 6:*Brachypetalum* | 7:*Barbata* |  |  |  |
|  |  |  | The order in Un-known x/y is <best\_sore>/<lower\_score>. No numbers? All scores are negative! | | | | |

Table 13 Results of second test of hybrids of *Paphiopedilum* sections *Parvisepalum* and *Brachypetalum*. Red: incorrect classified. Green: Correct classification to one of the parental sections. Green and bold: Correct classification to both parental sections. Yellow background and brown text: Unable to classify.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | ***Paphiopedilum* sect. *Parvisepalum* X *Brachypetalum* run2** | | | |  |  |
|  |  |  |  |  |  |  |  |
| **ANN** | **51** | **52** | **53** | **54** | **55** | **56** | **57** |
| **Desired Error** | 1,00E-04 | 1,00E-05 | 1,00E-06 | 1,00E-07 | 1,00E-08 | 1,00E-09 | 1,00E-10 |
| **Time to classify (s)** | 5 | 4 | 4 | 4 | 4 | 4 | 3 |
| **Picture** |  |  |  |  |  |  |  |
| armeniacumXconcolor2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| delenatiiXniveum2 | Unknown | Unknown | 1 | 2(low) | Unknown | 1 | 6 |
| armeniacumXconcolor1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| armeniacumXconcolor6 | 1 | 1 | 1 | 1 | 1 | 1 | 1(low) |
| emersoniiXbellatulum | 1 | 1&3 | 1&3 | 1 | Unknown | Unknown | Unknown |
| delenatiiXniveum1 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| armeniacumXconcolor5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| armeniacumXconcolor4 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|  |  |  |  |  |  |  |  |
|  |  |  | Legend |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  | 1 | *Parvisepalum* | 2 | *Pardalopetalum* |
|  |  |  |  | 3 | *Paphiopedilum* | 4 | *Coryopedilum* |
|  |  |  |  | 5 | *Cochlopetalum* | 6 | *Brachypetalum* |
|  |  |  |  | 7 | *Barbata* |  |  |

## Results of characteristic research

Table 14 Characteristics o*f Paphiopedilum* section *Barbata*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | ***Paphiopedilum* sect. *Barbata*** | | |  |  |  |
|  |  |  |  |  |  |  |  |
| **Characteristics** | | **argus1\*** | **argus2\_2§** | **mastersianum1\*** | **mastersianum2\_5§** | **tonsum1\*$** | **tonsum2\_2§** |
|  | |  |  |  |  |  |  |
| spathulate petals | | **!** | ✓ | ✓ | ✓ | **!** | ✓ |
| spotted and/or warted petals | | ✓ | ✓ | ✗ | ✓ | ✓ | ✓ |
| incurved side lobes | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
|  | Note | artificial white |  | artificial white |  | artificial white | artificial white |
|  |  | patches caused |  | patches caused |  | patches caused | patches caused |
|  |  | by scanning |  | by scanning |  | by scanning + | by scanning |
|  |  |  |  |  |  | Small pic. |  |
|  |  |  |  |  |  |  |  |
| **Characteristics** | | **tonsum2\*** | **tonsum3\*** | **wardii1\*** | **wardii2\_1§** |  |  |
|  | |  |  |  |  |  |  |
| spathulate petals | | ✓ | ✓ | ✗ | ✓ |  |  |
| spotted and/or warted petals | | ✓ | ✓ | ✓ | ✓ |  |  |
| incurved side lobes | | ✓ | ✓ | ✓ | ✓ |  |  |
|  | Note | artificial white | artificial white | artificial white |  |  |  |
|  |  | patches caused | patches caused | patches caused |  |  |  |
|  |  | by scanning | by scanning | by scanning |  |  |  |
| ✓ | Visible |  |  |  |  |  |  |
| **!** | Difficult to see | |  |  |  |  |  |
| ✗ | Invisible |  |  |  |  |  |  |
| \* | Picture scanned from Cribb, 1998 | | |  |  |  |  |
| § | Picture from dear.smartweb.tw | | |  |  |  |  |
| **Name** | Incorrectly identified to sectional level in max 1 of the 7 different networks | | | | |  |  |
| **Name** | Incorrectly identified to sectional level in max 3 of the 7 different networks | | | | |  |  |
| **Name** | Incorrectly identified to sectional level in more than 3 of the 7 networks | | | | |  |  |

Table 15 Characteristics of *Paphiopedilum* section *Brachypetalum*.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | ***Paphiopedilum* sect. *Brachypetalum*** | | |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **Characteristics** | | **concolor1\*** | **concolor2\_2§** | **concolor2\_4§** | **concolor2\_6§** | **concolor2\*** |
|  | |  |  |  |  |  |
| variously ornamented with purple spots | | ✓ | ✓ | ✓ | ✓ | ✓ |
| broad-elliptic petals | | ✓ | ✓ | ✓ | ✓ | **!** |
| small lip | | ✓ | ✓ | ✓ | ✓ | ✓ |
| ovoid lip | | ✓ | ✓ | ✓ | ✗ | ✓ |
| lip with incurved margin | | ✓ | ✗ | ✓ | ✓ | ✓ |
| pale yellow or white flower | | ✗ | ✓ | ✓ | ✓ | ✓ |
|  | |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| ✓ | Visible |  |  |  |  |  |
| **!** | Difficult to see |  |  |  |  |  |
| ✗ | Invisible |  |  |  |  |  |
| \* | Picture scanned from Cribb, 1998 | |  |  |  |  |
| § | Picture from dear.smartweb.tw | |  |  |  |  |
| **Name** | Incorrectly identified to sectional level in max 1 of the 7 different networks | | | |  |  |
| **Name** | Incorrectly identified to sectional level in max 3 of the 7 different networks | | | |  |  |
| **Name** | Incorrectly identified to sectional level in more than 3 of the 7 networks | | | |  |  |

Table 16 Characteristics of *Paphiopedilum* section *Coryopedilum*.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | ***Paphiopedilum* sect. *Coryopedilum*** | | |
|  |  |  |  |  |
|  |  |  |  |  |
| **Characteristics** | | **rothschildianium1\*** | **rothschildianium2\*** | **rothschildianium3\*** |
|  | |  |  |  |
| Long petals | | ✓ | ✓ | ✓ |
| Petals hanging down | | ✓ | ✓ | ✓ |
| Tapering petals | | ✓ | ✓ | ✓ |
| Spirally twisted petals | | ✓ | ✓ | **!** |
| Warts on margins of petals | | ✗ | ✗ | ✗ |
| Glandular at tip | | ✗ | ✗ | ✗ |
| incurved side lobes | | ✓ | ✗ | ✗ |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| ✓ | Visible |  |  |  |
| **!** | Difficult to see | |  |  |
| ✗ | Invisible |  |  |  |
| \* | Picture scanned from Cribb, 1998 | |  |  |
| § | Picture from dear.smartweb.tw | |  |  |
| **Name** | Incorrectly identified to sectional level in max 1 of the 7 different networks | | | |
| **Name** | Incorrectly identified to sectional level in max 3 of the 7 different networks | | | |
| **Name** | Incorrectly identified to sectional level in more than 3 of the 7 networks | | | |

Table 17 Characteristics of *Paphiopedilum* section *Parvisepalum*.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | ***Paphiopedilum* sect. *Parvisepalum*** | | |  |  |
|  |  |  |  |  |  |  |
| **Characteristics** | | **delenatii1\*** | **delenatii2\_2§** | **delenatii2\_4§** | **delenatii2\_6§** | **delenatii2\*** |
|  | |  |  |  |  |  |
| broad-elliptic petals | | ✓ | ✓ | ✓ | ✓ | ✓ |
| subcircular petals | | ✓ | ✓ | ✓ | ✓ | **!** |
| large staminode | | ✓ | ✓ | ✓ | ✓ | ✓ |
| cream/yellow coloured petals | | ✗ | ✓ | ✓ | ✓ | ✗ |
|  | Note | artificial white |  |  |  | artificial brown |
|  |  | patches caused |  |  |  | patches caused |
|  |  | by scanning |  |  |  | by scanning |
|  |  |  |  |  |  |  |
| **Characteristics** | | **emersonii1\*** | **emersonii2\_1§** | **emersonii2\_3§** | **emersonii2\_5§** | **malipoense1\*** |
|  | |  |  |  |  |  |
| broad-elliptic petals | | ✓ | ✓ | ✓ | ✓ | ✓ |
| subcircular petals | | ✓ | ✓ | ✓ | ✓ | ✗ |
| large staminode | | ✓ | ✓ | ✓ | ✓ | ✓ |
| cream/yellow coloured petals | | ✗ | ✗ | ✓ | ✗ | ✓ |
|  | Note | artificial white | Flower dark |  | Flower grey/ |  |
|  |  | patches caused |  |  | blue like |  |
|  |  | by scanning |  |  |  |  |
|  |  |  |  |  |  |  |
| **Characteristics** | | **malipoense2\_10§** | **malipoense2\_12§** | **malipoense2\_14§** | **malipoense2\_8§** | **malipoense2\*** |
|  | |  |  |  |  |  |
| broad-elliptic petals | | ✓ | ✓ | ✓ | ✓ | **!** |
| subcircular petals | | ✓ | ✓ | ✓ | ✓ | ✗ |
| large staminode | | ✓ | ✓ | ✓ | ✓ | ✓ |
| cream/yellow coloured petals | | ✓ | ✓ | ✓ | ✓ | ✗ |
|  | Note |  |  |  |  | Not fully frontal |
| **Characteristics** | | **malipoense3\*** | **malipoense2\_16§** | **malipoense2\_18§** | **malipoense2\_2§** | **malipoense2\_4§** |
|  | |  |  |  |  |  |
| broad-elliptic petals | | **!** | ✓ | ✓ | ✓ | ✓ |
| subcircular petals | | ✗ | ✓ | ✓ | ✓ | ✓ |
| large staminode | | ✓ | ✓ | ✓ | ✓ | ✓ |
| cream/yellow coloured petals | | ✗ | ✓ | ✓ | ✓ | ✓ |
|  | Note | Not fully frontal |  |  |  |  |
|  |  |  |  |  |  |  |
| **Characteristics** | | **malipoense2\_6§** |  |  |  |  |
|  | |  |  |  |  |  |
| broad-elliptic petals | | ✓ |  |  |  |  |
| subcircular petals | | ✓ |  |  |  |  |
| large staminode | | ✓ |  |  |  |  |
| cream/yellow coloured petals | | ✓ |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| ✓ | Visible |  |  |  |  |  |
| **!** | Difficult to see |  |  |  |  |  |
| ✗ | Invisible |  |  |  |  |  |
| \* | Picture scanned from Cribb, 1998 | |  |  |  |  |
| § | Picture from dear.smartweb.tw | |  |  |  |  |
| **Name** | Incorrectly identified to sectional level in max 1 of the 7 different networks | | | |  |  |
| **Name** | Incorrectly identified to sectional level in max 3 of the 7 different networks | | | |  |  |
| **Name** | Incorrectly identified to sectional level in more than 3 of the 7 networks | | | |  |  |

## Screenshots of the classification website

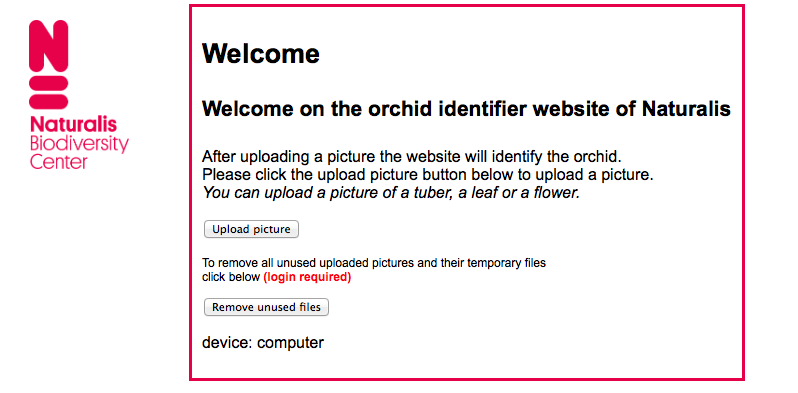


Figure S-1 Homepage of the classification website

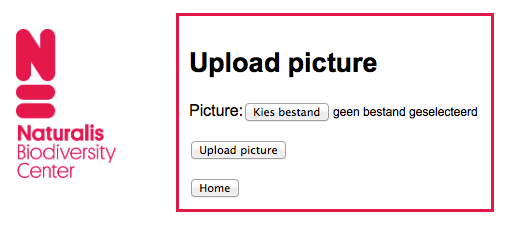


Figure S-2 Upload page of the classification website

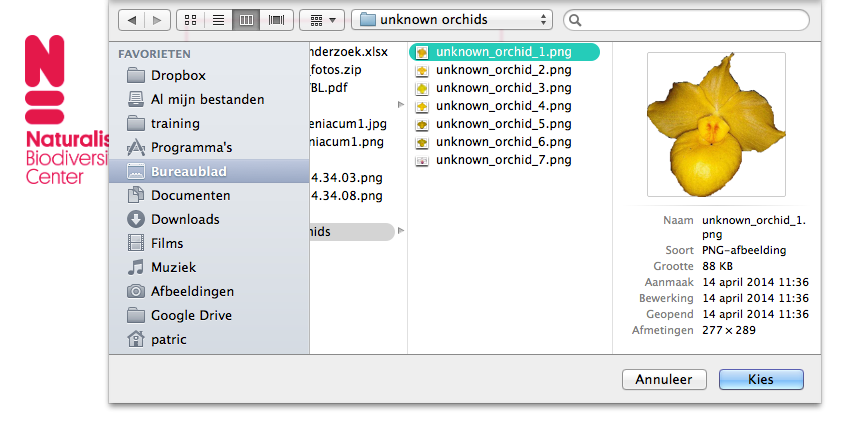


Figure S-3 Screen to select the picture to be classified

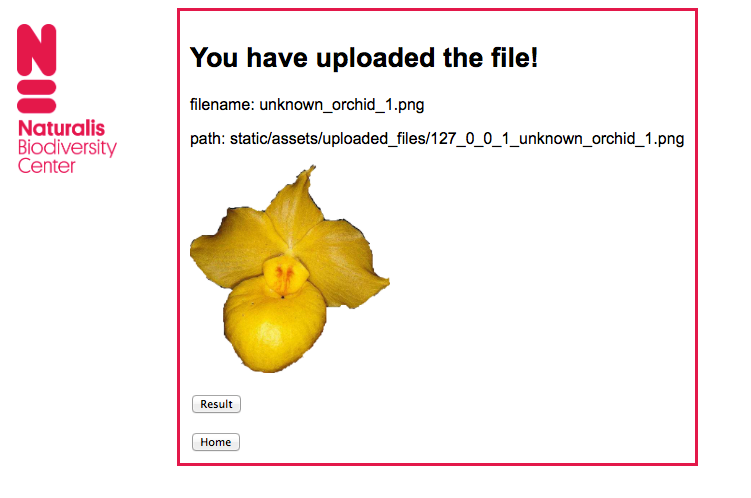


Figure S-4 page to check if the picture is uploaded correctly

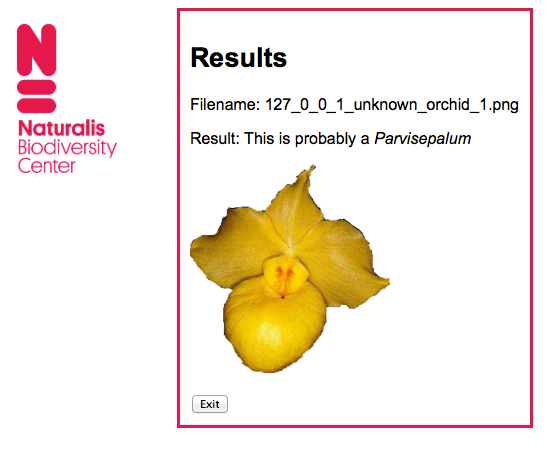


Figure S-5 Result page of the classification website.

# Appendices

## Photographs of *salep* orchid look-a-likes (pictures made by Patrick Wijntjes)



Figure 10 *Arum maculatum* [15]



Figure 11 *Asparagus officinalis* [15]



Figure 12 *Polygonatum verticillatum* [15]



Figure 13 *Tulipa greigii* [15]



Figure 14 *Tulipa sp.* [15]



Figure 15 A: A picture of a tuber, before splitting. B: A picture of the same tuber after splitting [15].

## Input and output files

### Example of an xml file

<photo id="12342126885" secret="ca74c114fa" server="7451" farm="8" dateuploaded="1391690138" isfavorite="0" license="0" safety\_level="2" rotation="0" originalsecret="29fddd19e8" originalformat="jpg" views="0" media="photo">

<owner nsid="113733456@N06" username="patrick\_naturalis" realname="Patrick Wijntjes" location="" iconserver="0" iconfarm="0" path\_alias=""/>

<title>charlesworthii5</title>

<description/>

<visibility ispublic="0" isfriend="0" isfamily="0"/>

<dates posted="1391690138" taken="2012-08-29 17:13:09" takengranularity="0" lastupdate="1391690248"/>

<permissions permcomment="0" permaddmeta="0"/>

<editability cancomment="1" canaddmeta="1"/>

<publiceditability cancomment="0" canaddmeta="0"/>

<usage candownload="1" canblog="1" canprint="1" canshare="0"/>

<comments>0</comments>

<notes/>

<people haspeople="0"/>

<tags>

<tag id="113688134-12342126885-10993197" author="113733456@N06" raw="genus:Paphiopedilum" machine\_tag="0">genuspaphiopedilum</tag>

<tag id="113688134-12342126885-188931923" author="113733456@N06" raw="species:chariesworthii" machine\_tag="0">specieschariesworthii</tag>

<tag id="113688134-12342126885-535" author="113733456@N06" raw="Flower" machine\_tag="0">flower</tag>

</tags>

<urls>

<url type="photopage">http://www.flickr.com/photos/113733456@N06/12342126885/</url>

</urls>

</photo>

### Tag file of a flower

bellatulum12 phot

genus:Brachypetalum

species:bellatulum

Flower

### Tag file of an *salep* tuber

TEH-1.1\_5

Orchid\_spur

Orchid

Spur

genus:Dactylorhiza

species:incarnata

Tuber

### Tag file of a Look-a-Like tuber

tulipa red riding hood3

Look-a-Like\_round

Look-a-Like

Round

genus:Tulipa

species:greigii

Tuber

## Codes

### Bash

#### training.sh

clear

#===================================================================================================#

# Download pictures from Flickr #

#===================================================================================================#

#Download pictures from Flickr

python Offlickr.py -p -n -i 113733456@N06 -d .

#List all xml files and save it in a

ls | egrep xml > a

#Get the tags for every picture

python get\_tags.py

#remove all xml files and the list of xml files saved in a

rm \*.xml a

#Clear the screen, ask the user to check manually if al pictures are download correctly. If not, download them by hand.

clear

echo "Pictures downloaded"

echo "Please check the downloaded pictures."

echo "Download all broken pictures by hand."

echo "log in on Flickr with the shared naturalis account and go to:"

echo "https://www.flickr.com/photos/113733456@N06/<picture\_id>/sizes/o/"

echo "Press enter to continue"

read

#===================================================================================================#

# Divide pictures between Flower and Tuber #

#===================================================================================================#

#Create the required directories

mkdir Flower Tuber Tuber/LOblong Tuber/LSpur Tuber/LRound Tuber/Oblong Tuber/Round Tuber/Spur

#Loop through every jpg file

for i in \*.jpg

do

var=(${i//./ }$0)

tags="$var""\_tags.txt"

#Convert from jpg to png

echo "Convert $i to $var.png"

convert $i $var.png

content=$(cat $tags)

echo "---------------------------------------------"

#Divide the picture and tags between Tuber and Flower

if [[ $content == \*Tuber\* ]]

then

mv $var.png Tuber

mv $tags Tuber

elif [[ $content == \*Flower\* ]]

then

mv $var.png Flower

mv $tags Flower

else

echo "No correct tag found"

echo "=================================================="

fi

done

#Remove the jpg that will not be used anymore

rm \*.jpg

#Clear the screen, print a message and wait for input from the user.

clear

echo "Pictures divided between flower and tuber"

echo "Press enter to continue"

read

#===================================================================================================#

# Divide the pictures in Flower between the different genera and the different species #

#===================================================================================================#

#go into the Flower directory

cd Flower

#Loop through the png files

for f in \*.png

do

var=(${f//./ }$0)

tags="$var""\_tags.txt"

#Create variables that will be used to create directories.

content=$(cat $tags)

genusi=$(sed -n '3p' < $tags)

speciesi=$(sed -n '4p' < $tags)

genus=(${genusi##\*:})

species=(${speciesi##\*:})

#Create a directory with the name of the genus

mkdir $genus

#Move the picture and tag file to the correct directory

mv $f $genus

mv $tags $genus

#Go into the genus directory and create a directory with the name of the species

cd $genus

mkdir $species

#Move the picture and tag file to the correct directory

mv $f $species

mv $tags $species

#Go back to the Flower directory

cd ..

done

#After looping through the png files in the Flower directory go out of this directory

cd ..

#Clear the screen, print a message and wait for input from the user

clear

echo "Flower pictures divided"

echo "Press enter to continue"

read

#===================================================================================================#

# Divide the pictures in Tuber between shape(L-a-L) #

#===================================================================================================#

#Go into the Tuber Directory

cd Tuber

for f in \*.png

do

#Create the variables to divide the pictures.

var=(${f//./ }$0)

tags="$var""\_tags.txt"

content=$(cat $tags)

#Divide the pictures to the correct directory

if [[ $content == \*Look-a-Like\_round\* ]]

then

mv $var.png LRound/

mv $tags LRound/

elif [[ $content == \*Look-a-Like\_oblong\* ]]

then

mv $var.png LOblong/

mv $tags LOblong/

elif [[ $content == \*Look-a-Like\_spur\* ]]

then

mv $var.png LSpur/

mv $tags LSpur/

elif [[ $content == \*Round\* ]]

then

mv $var.png Round/

mv $tags Round/

elif [[ $content == \*Oblong\* ]]

then

mv $var.png Oblong/

mv $tags Oblong/

elif [[ $content == \*Spur\* ]]

then

mv $var.png Spur/

mv $tags Spur/

else

echo "No correct tag found"

fi

done

#After looping through the png files in the Tuber directory go out of this directory

cd ..

#Clear the screen, print a message and ask the user if he wants to split the Tuber pictures.

clear

echo "Tuber pictures divided"

echo "Do you want to split the pictures of Tuber? (y or n)"

read $split

#===================================================================================================#

# Split all pictures of Tuber #

#===================================================================================================#

# When the input is a y or a Y split the Tuber pictures

if [ "$split" == "y" ] || [ "$split" == "Y" ];

then

#Go into the Tuber directory

cd Tuber

#Loop through all directories in this folder

for i in $(ls -d \*/)

do

y=${i%%/}

#Set standard parameter values

size=10000

t=0.65

#Some directories requires other values for size or for t

if [[ $y == \*LO\* ]]

then

size=50000

elif [[ $y == \*LS\* ]]

then

size=50000

elif [[ $y == R\* ]]

then

t=0.6

fi

#Loop through all pictures

for f in ./$y/\*.png

do

#Split the picture, using the given parameter values

echo "Splitting $f"

perl ../splitter.pl -t $t -i $f

#Remove the noise pictures using the file size

for FILENAME in \*,\*.png

do

FILESIZE=$(stat -f%z $FILENAME)

if (( FILESIZE > size ))

then

mv $FILENAME ./$y

else

rm $FILENAME

fi

done

done

done

#When this step is finished go out of the Tuber directory

cd ..

#Clear the screen and print a message

clear

echo "Tuber pictures splited"

#If the input is not y or Y

else

#Print a message that the pictures will not be split

echo "The pictures wouldn't be split"

fi

#Print a finish message

echo "The program is finished"

#### modify\_flower\_data.sh

#Go into the Flower directory

cd Flower

#Loop through the directories

for directory in $(ls -d \*/)

do

#Go into the directory

cd $directory

#Run combine\_files.py

echo "Run combine\_files.py"

python ../../combine\_files.py

#Go back to the Flower directory

cd ..

done

#Run add\_columns.py

echo "Run add\_columns.py"

python ../add\_columns.py

#Print a finishing message

echo "Finished"

#### create\_traindata.sh

#Loop through the directories

for i in $(ls -d \*/)

do

directories=${i%%/}

# echo ${i%%/}

#The tuber pictures use another Perl script for training the neural network

#than the flower pictures. So check the name of the directory.

if [[ $directories == T\* ]]

#If it starts with T (=Tuber)

then

#Go into the directory

cd $directories

#Loop through the directories

for x in $(ls -d \*/)

do

#Create variables

category=0

shape=${x%%/}

echo "run traindata.pl for $shape"

#Give the Look-a-like tubers category -1

if [[ $shape == L\* ]]

then

category=-1

#Give the salep tubers category 1

else

category=1

fi

#Run the train data script and write the output to a tsv file.

#Give this file the name of the current directory

perl ../traindata.pl -d ./$shape -c $category > $shape.tsv

done

#After looping through the directories go out of the Tuber directory

cd ..

elif [[ $directories == F\* ]]

#If it starts with F (=Flower)

then

#Go into the directory

cd $directories

#Loop through the section directories

for section in $(ls -d \*/)

do

#Go into the section directory

cd $section

#Loop through the species directories

for z in $(ls -d \*/)

do

#Create variables

species=${z%%/}

echo "run traindata2.pl for $species"

#Run the traindata2 script and redirect the output to a tsv file.

#Give this file the name of the current directory

perl ../../traindata2.pl -d ./$species -c 0 > $species.tsv

done

#After looping through the species directories go back to the Flower directory

cd ..

done

#After looping through the genus directories go out of the Flower directory

cd ..

fi

done

clear

echo "Done"

### Css

#### computer.css

/\* This is the default lay-out for the webpages \*/

@media screen {

/\* Lay-out for the body \*/

body {

/\* Place the text in the middle of the page \*/

text-align: center;

}

/\* Lay-out for the page \*/

#page {

/\* the width \*/

width: 960px;

/\* place the text left \*/

text-align: left;

/\* clear automatically the area around the page \*/

margin: 10px auto 20px auto;

/\* Set the background color to white \*/

background-color:white;

}

/\* Lay-out for the logo \*/

#logo {

/\* Place the logo on the left side of the page \*/

float: left;

/\* the width of the logo is 200 pixels \*/

width: 200px;

}

/\* Lay-out for sidebar, not used, but available for later \*/

/\*#sidebar {

float: right;

width: 200px;

border: 1px solid #E3004A;

}\*/

/\* Lay-out for the content \*/

#content {

/\* place the content left, because logo is described first, the content will

be displayed right of the logo \*/

float: left;

/\* The width of this box will be automatically changed to the content \*/

width: auto;

/\* Place a border around the content

3 pixels width with a pink-like color, The same color of the

Naturalis logo \*/

border: 3px solid #E3004A;

/\* Clear 10 pixels around the content, inside de border \*/

padding: 10px;

}

/\* Lay-out for the footer \*/

#footer {

/\* Place the footer on the bottom \*/

position:absolute;

bottom:10px;

}

/\* Standard font settings for a paragraph \*/

p {

font-family: Arial;

font-size: 1em;

}

/\* Standard font settings for a Header1 \*/

h1 {

font-family: Arial;

font-size: 1.9em;

}

/\* Standard font settings for a Header2 \*/

h2 {

font-family: Arial;

font-size: 1.7em;

}

/\* Standard font settings for a Header3 \*/

h3 {

font-family: Arial;

font-size: 1.5em;

}

/\* Standard font settings for a Header4 \*/

h4 {

font-family: Arial;

font-size: 1.3em;

}

/\* Standard font settings for text with id small \*/

#small {

font-size: 0.75em;

}

/\* Standard font settings for the forms \*/

form {

font-family: Arial;

font-size: 1em;

}

/\* Standard font settings for the input box \*/

input {

font-family: Arial;

font-size: 1em;

}

/\* Standard font settings for the text with id button \*/

#button {

font-family: Arial;

font-size: 1.25em;

}

}

#### mobile.css

@media handheld {

/\* Lay-out for the body \*/

body {

/\* Place the text in the middle of the page \*/

text-align: center;

}

/\* Lay-out for the logo \*/

#logo {

/\* Place the logo on the left side of the page \*/

float: left;

/\* the width of the logo is 200 pixels \*/

width: 200px;

}

/\* Lay-out for sidebar, not used, but available for later \*/

/\*#sidebar {

float: right;

width: 200px;

border: 1px solid #E3004A;

}\*/

/\* Lay-out for the content \*/

#content {

/\* place the content left, because logo is described first, the content will

be displayed right of the logo \*/

float: left;

/\* The width of this box will be automatically changed to the content self \*/

width: auto;

/\* Place a border around the content

3 pixels width with a pink-like color, The same color of the

Naturalis logo \*/

border: 13px solid #E3004A;

/\* Clear 10 pixels around the content, inside de border \*/

padding: 10px;

}

/\* Lay-out for the footer \*/

#footer {

/\* Place the footer on the bottom \*/

position:absolute;

bottom:10px;

}

/\* Standard font settings for a paragraph \*/

p {

font-family: Arial;

font-size: 2em;

}

/\* Standard font settings for a Header1 \*/

h1 {

font-family: Arial;

font-size: 3.8em;

}

/\* Standard font settings for a Header2 \*/

h2 {

font-family: Arial;

font-size: 3.4em;

}

/\* Standard font settings for a Header3 \*/

h3 {

font-family: Arial;

font-size: 3em;

}

/\* Standard font settings for a Header4 \*/

h4 {

font-family: Arial;

font-size: 2.6em;

}

/\* Standard font settings for text with id small \*/

#small {

font-size: 1.25em;

}

/\* Standard font settings for the forms \*/

form {

font-family: Arial;

font-size: 2em;

}

/\* Standard font settings for the input box \*/

input {

font-family: Arial;

font-size: 2em;

}

/\* Standard font settings for the text with id button \*/

#button {

font-family: Arial;

font-size: 2.5em;

}

}

### Html

#### computer\_invalid\_login.html

<!-- Use the computer template and override the content block -->

{% extends "computer.html" %}

<!-- Override the title -->

{% block title %}Orchid Identifier - Invalid login{% endblock %}

{% block content %}

<!-- All lines in this block will be displayed in the content block -->

<!-- Display a header, telling the login details are incorrect -->

<h2>Your login details are invalid!</h2>

<!-- Button to login again -->

<form action="/accounts/login/">

<!-- The submit button with the text Try again inside -->

<input type="submit" value="Try again" id="button">

</form>

<p></p>

<!-- Button to go back to the welcome page -->

<form action="/welcome/">

<!-- The submit button with the text Home inside -->

<input type="submit" value="Home" id="button">

</form>

{% endblock %}

#### computer\_login.html

<!-- Use the computer template and override the content block -->

{% extends "computer.html" %}

<!-- Override the title -->

{% block title %}Orchid Identifier - Login{% endblock %}

{% block content %}

<!-- All lines in this block will be displayed in the content block -->

<!-- Display a header -->

<h3>Login required to remove files!</h3>

<!-- Ask for the username and password -->

<form action="/accounts/auth/" method="post">{% csrf\_token %}

<label for="username">User name:</label>

<input type="text" name="username" value="" id="username">

<p></p>

<label for="password">Password:</label>

<input type="password" name="password" value="" id="password">

<p></p>

<input type="submit" value="login" id="button">

</form>

<p></p>

<!-- Button to go back to the home page -->

<form action="/welcome/">

<!-- The submit button with the text Home inside -->

<input type="submit" value="Home" id="button">

</form>

{% endblock %}

#### computer\_remove.html

<!-- Use the computer template and override the content block -->

{% extends "computer.html" %}

<!-- Override the title -->

{% block title %}Orchid Identifier - Files removed{% endblock %}

{% block content %}

<!-- All lines in this block will be displayed in the content block -->

<!-- Display a header, telling the task has been completed -->

<h2>Removing complete!</h2>

<!-- Give detailed information -->

<p>All uploaded pictures and their results<BR>

are moved to the results directory</p>

<p>You have removed the following files:</p>

<p>{{uploads}}</p>

<p>{{temps}}</p>

<!-- Button to logout -->

<form action="/accounts/logout/">

<!-- The submit button with the text Upload picture inside -->

<input type="submit" value="Logout" id="button">

</form>

{% endblock %}

#### computer\_result.html

<!-- Use the computer template and override the content block -->

{% extends "computer.html" %}

<!-- Override the title -->

{% block title %}Orchid Identifier - Result{% endblock %}

{% block content %}

<!-- All lines in this block will be displayed in the content block -->

<!-- The displaying content is only for testing and needs to be updated

for the real version -->

<!-- Display a header to tell this is de result page -->

<h2>Results</h2>

<!-- FOR TESTING: Display the filename -->

<p>Filename: {{filename}} </p>

<!-- Display the result -->

<!-- WARNING: this is a test result, and will always be a random sentence

This needs to be changed for the real version! -->

<p>Result: {{result}} </p>

<!-- Display the picture, give it a link to view the picture on a new

webpage / tab -->

<p><a href="/static/assets/uploaded\_files/{{filename}}"><img src="/static/assets/uploaded\_files/{{filename}}" width="200"/></a></p>

<form action="/exit/">

<!-- The submit button with the text Upload picture inside -->

<input type="submit" value="Exit" id="button">

</form>

{% endblock %}

#### computer\_sorry.html

<!-- Use the computer template and override the content block -->

{% extends "computer.html" %}

<!-- Override the title -->

{% block title %}Orchid Identifier - Error{% endblock %}

{% block content %}

<!-- All lines in this block will be displayed in the content block -->

<!-- Header -->

<h2>Sorry!</h2>

<!-- Explain the error and ask to try again -->

<p>During the calculation, your picture has been removed.<BR>

Please try again</p>

<!-- Button to try again -->

<form action="/upload/">

<!-- The submit button with the text Upload picture inside -->

<input type="submit" value="Upload picture" id="button">

</form>

<p></p>

<!-- Button to go back to the homepage -->

<form action="/welcome/">

<!-- The submit button with the text Home inside -->

<input type="submit" value="Home" id="button">

</form>

{% endblock %}

#### computer\_upload\_succes.html

<!-- Use the computer template and override the content block -->

{% extends "computer.html" %}

<!-- Override the title -->

{% block title %}Orchid Identifier - Upload succeeded{% endblock %}

{% block content %}

<!-- All lines in this block will be displayed in the content block -->

<!-- The displaying content is only for testing and needs to be updated

for the real version -->

<!-- Display a header, telling the file is uploaded -->

<h2>You have uploaded the file!</h2>

<!-- FOR TESTING: Display the filename -->

<p>filename: {{filename}}</p>

<!-- FOR TESTING: Display the path to the file -->

<p>path: {{path}}</p>

<!-- Display the picture, give it a link to view the picture on a new

webpage / tab -->

<p><a href="/{{path}}"><img src="/{{path}}" width="200"/></a></p>

<form action="/result/">

<!-- The submit button with the text Upload picture inside -->

<input type="submit" value="Result" id="button">

</form>

<!-- Display an empty line between both buttons-->

<p></p>

<form action="/welcome/">

<!-- The submit button with the text Home inside -->

<input type="submit" value="Home" id="button">

</form>

{% endblock %}

#### computer\_upload.html

<!-- Use the computer template and override the content block -->

{% extends "computer.html" %}

<!-- Override the title -->

{% block title %}Orchid Identifier - Upload picture{% endblock %}

{% block content %}

<!-- All lines in this block will be displayed in the content block -->

<!-- The displaying content is only for testing and needs to be updated

for the real version -->

<!-- Display a header to tell this is de upload page -->

<h2>Upload picture</h2>

<p style="color:red; font-size:0.9em"><em>{{message}}</em></p>

<!-- Use the form from orchid.views.upload to receive a picture -->

<form action="" method="post" style="{{style}}" enctype="multipart/form-data">{% csrf\_token %}

{{form}}

<p></p>

<!-- Place a submit button under the form, with the text Upload picture inside.

To place it under the form, it is required to display an empty line first-->

<input type="submit" value="Upload picture" id="button">

<!-- End of form -->

</form>

<p></p>

<!-- Place a button under the form to go back to the home screen -->

<form action="/welcome/">

<input type="submit" value="Home" id="button">

</form>

{% endblock %}

#### computer\_welcome.html

<!-- Use the computer template and override the content block -->

{% extends "computer.html" %}

<!-- Override the title -->

{% block title %}Orchid Identifier - Home{% endblock %}

{% block content %}

<!-- All lines in this block will be displayed in the content block -->

<!-- The displaying content is only for testing and needs to be updated

for the real version -->

<!-- Display a header, telling this is the welcome page -->

<h2>Welcome</h2

<!-- Tell the user what this web application will do -->

<h4>Welcome on the orchid identifier website of Naturalis</h4>

<p>After uploading a picture the website will identify the orchid.<BR>

Please click the upload picture button below to upload a picture.<BR>

<em>You can upload a picture of a tuber, a leaf or a flower.</em></p>

<!-- Create a form that contains two buttons.

The first button is for uploading the file -->

<form action="/upload/">

<!-- The submit button with the text Upload picture inside -->

<input type="submit" value="Upload picture" id="button">

</form>

<!-- display a white line -->

<p></p>

<!-- Second button to remove all leftover files -->

<p id="small">To remove all unused uploaded pictures and their temporary files<BR>

click below <span style="color: red"><strong>(login required)</strong></span></p>

<form action="/admin/remove">

<input type="submit" value="Remove unused files" id="button">

</form>

<!-- FOR TESTING: Print the used devise -->

<p>device: {{device}}</p>

{% endblock %}

#### computer.html

<!-- THIS IS THE STANDARD HTML FOR THE COMPUTER LAYOUTS -->

<!-- Load in the static function -->

{% load static %}

<!-- declare the DOCTYPE and html language-->

<!DOCTYPE html>

<html lang="en">

<!-- Create the head -->

<head>

<!-- Create a title using a block -->

<!-- This title needs to be changed! The best way to change the title

is in the other html files witch extends this html -->

<title>{% block title %} My Base Template{% endblock %}</title>

<!-- Use the compyter.css style sheet for all the layouts -->

<link rel="style sheet" type="text/css" href="{% static "assets/css/computer.css" %}">

<!-- end of the head -->

</head>

<!-- Create the body -->

<body>

<!-- Create a page -->

<div id="page">

<!-- Create a logo block, using the logo layout from compyter.css -->

<div id="logo">

{% block logo %}

<!-- Place the Naturalis logo inside the logo block -->

<ul>

<a href="<http://www.naturalis.nl>"><img src="{% static "assets/images/Naturalis\_logo.png" %}" width="100"/></a>

</ul>

<!-- End of the logo block -->

{% endblock %}

</div>

<!-- Create a content block, using the content layout from computer.css -->

<div id="content">

<!-- Place a standard text in the content -->

<!-- This block will be override for all different html pages -->

{% block content %}This is the content of this block{% endblock %}

</div>

<!-- Create a footer block, using the footer layout from computer.css -->

<div id="footer">

<!-- Place some text in the footer block -->

{% block footer %}<p>&copy;2013-2014 Patrick Wijntjes</p>{% endblock %}

<!-- End of the page -->

</div>

<!-- End of the body and of the html -->

</body>

</html>

#### mobile\_invalid\_login.html

<!-- Use the mobile template and override the content block -->

{% extends "mobile.html" %}

<!-- Override the title -->

{% block title %}Orchid Identifier - Invalid login{% endblock %}

{% block content %}

<!-- All lines in this block will be displayed in the content block -->

<!-- Display a header, telling the login details are incorrect -->

<h2>Your login details are invalid!</h2>

<!-- Button to login again -->

<form action="/accounts/login/">

<!-- The submit button with the text Try again inside -->

<input type="submit" value="Try again" id="button">

</form>

<p></p>

<!-- Button to go back to the welcome page -->

<form action="/welcome/">

<!-- The submit button with the text Home inside -->

<input type="submit" value="Home" id="button">

</form>

{% endblock %}

#### mobile\_login.html

<!-- Use the mobile template and override the content block -->

{% extends "mobile.html" %}

<!-- Override the title -->

{% block title %}Orchid Identifier - Login{% endblock %}

{% block content %}

<!-- All lines in this block will be displayed in the content block -->

<!-- Display a header -->

<h3>Login required to remove files!</h3>

<!-- Ask for the username and password -->

<form action="/accounts/auth/" method="post">{% csrf\_token %}

<label for="username">User name:</label>

<input type="text" name="username" value="" id="username">

<p></p>

<label for="password">Password:</label>

<input type="password" name="password" value="" id="password">

<p></p>

<input type="submit" value="login" id="button">

</form>

<p></p>

<!-- Button to go back to the home page -->

<form action="/welcome/">

<!-- The submit button with the text Home inside -->

<input type="submit" value="Home" id="button">

</form>

{% endblock %}

#### mobile\_remove.html

<!-- Use the mobile template and override the content block -->

{% extends "mobile.html" %}

<!-- Override the title -->

{% block title %}Orchid Identifier - Files removed{% endblock %}

{% block content %}

<!-- All lines in this block will be displayed in the content block -->

<!-- Display a header, telling the task has been completed -->

<h2>Removing complete!</h2>

<!-- Give detailed information -->

<p>All uploaded pictures and their results<BR>

are moved to the results directory</p>

<p>You have removed the following files:</p>

<p>{{uploads}}</p>

<p>{{temps}}</p>

<!-- Button to logout -->

<form action="/accounts/logout/">

<!-- The submit button with the text Upload picture inside -->

<input type="submit" value="Logout" id="button">

</form>

{% endblock %}

#### mobile\_result.html

<!-- Use the mobile template and override the content block -->

{% extends "mobile.html" %}

<!-- Override the title -->

{% block title %}Orchid Identifier - Result{% endblock %}

{% block content %}

<!-- All lines in this block will be displayed in the content block -->

<!-- The displaying content is only for testing and needs to be updated

for the real version -->

<!-- Display a header to tell this is de result page -->

<h2>Results</h2>

<!-- FOR TESTING: Display the filename -->

<p>Filename: {{filename}} </p>

<!-- Display the result -->

<!-- WARNING: this is a test result, and will always be a random sentence

This needs to be changed for the real version! -->

<p>Result: {{result}} </p>

<!-- Display the picture, give it a link to view the picture on a new

webpage / tab -->

<!-- Misschien de grootte aanpassen! -->

<p><a href="/static/assets/uploaded\_files/{{filename}}"><img src="/static/assets/uploaded\_files/{{filename}}" width="200"/></a></p>

<form action="/exit/">

<!-- The submit button with the text Upload picture inside -->

<input type="submit" value="Exit" id="button">

</form>

{% endblock %}

#### mobile\_sorry.html

<!-- Use the mobile template and override the content block -->

{% extends "mobile.html" %}

<!-- Override the title -->

{% block title %}Orchid Identifier - Error{% endblock %}

{% block content %}

<!-- All lines in this block will be displayed in the content block -->

<!-- Header -->

<h2>Sorry!</h2>

<!-- Explain the error and ask to try again -->

<p>During the calculation, your picture has been removed.<BR>

Please try again</p>

<!-- Button to try again -->

<form action="/upload/">

<!-- The submit button with the text Upload picture inside -->

<input type="submit" value="Upload picture" id="button">

</form>

<p></p>

<!-- Button to go back to the homepage -->

<form action="/welcome/">

<!-- The submit button with the text Home inside -->

<input type="submit" value="Home" id="button">

</form>

{% endblock %}

#### mobile\_upload\_succes.html

<!-- Use the mobile template and override the content block -->

{% extends "mobile.html" %}

<!-- Override the title -->

{% block title %}Orchid Identifier - Upload succeeded{% endblock %}

{% block content %}

<!-- All lines in this block will be displayed in the content block -->

<!-- The displaying content is only for testing and needs to be updated

for the real version -->

<!-- Display a header, telling the file is uploaded -->

<h2>You have uploaded the file!</h2>

<!-- FOR TESTING: Display the filename -->

<p>filename: {{filename}}</p>

<!-- FOR TESTING: Display the path to the file -->

<p>path: {{path}}</p>

<!-- Display the picture, give it a link to view the picture on a new

webpage / tab -->

<p><a href="/{{path}}"><img src="/{{path}}" width="200"/></a></p>

<form action="/result/">

<!-- The submit button with the text Upload picture inside -->

<input type="submit" value="Result" id="button">

</form>

<!-- Display an empty line between both buttons-->

<p style="font-size:10;"></p>

<form action="/welcome/">

<!-- The submit button with the text Home inside -->

<input type="submit" value="Home" id="button">

</form>

{% endblock %}

#### mobile\_upload.html

<!-- Use the mobile template and override the content block -->

{% extends "mobile.html" %}

<!-- Override the title -->

{% block title %}Orchid Identifier - Upload picture{% endblock %}

{% block content %}

<!-- All lines in this block will be displayed in the content block -->

<!-- The displaying content is only for testing and needs to be updated

for the real version -->

<!-- Display a header to tell this is de upload page -->

<h2>Upload picture</h2>

<!-- Font-size needs to be changed!!!!! -->

<p style="{{style}};"><em>{{message}}</em></p>

<!-- Use the form from orchid.views.upload to receive a picture -->

<form action="" method="post" style="{{style}}; font-size:60px" enctype="multipart/form-data">{% csrf\_token %}

{{form}}

<p></p>

<!-- Place a submit button under the form, with the text Upload picture inside.

To place it under the form, it is required to display an empty line first-->

<input type="submit" value="Upload picture" id="button">

<!-- End of form -->

</form>

<p></p>

<!-- Place a button under the form to go back to the home screen -->

<form action="/welcome/">

<input type="submit" value="Home" id="button">

</form>

{% endblock %}

#### mobile\_welcome.html

<!-- Use the mobile template and override the content block -->

{% extends "mobile.html" %}

<!-- Override the title -->

{% block title %}Orchid Identifier - Home{% endblock %}

{% block content %}

<!-- All lines in this block will be displayed in the content block -->

<!-- The displaying content is only for testing and needs to be updated

for the real version -->

<!-- Display a header, telling this is the welcome page -->

<h2>Welcome</h2

<!-- Tell the user what this web application will do -->

<h4>Welcome on the orchid identifier website of Naturalis</h4>

<p>After uploading a picture the website will identify the orchid.<BR>

Please click the upload picture button below to upload a picture.<BR>

<em>You can upload a picture of a tuber, a leaf or a flower.</em></p>

<!-- Create a form that contains two buttons.

The first button is for uploading the file -->

<form action="/upload/">

<!-- The submit button with the text Upload picture inside -->

<input type="submit" value="Upload picture" id="button">

</form>

<!-- display a white line -->

<p></p>

<!-- Second button to remove all leftover files -->

<p id="small">To remove all unused uploaded pictures and their temporary files<BR>

click below <span style="color: red"><strong>(login required)</strong></span></p>

<form action="/admin/remove">

<input type="submit" value="Remove unused files" id="button">

</form>

<!-- FOR TESTING: Print the used devise -->

<p>device: {{device}}</p>

{% endblock %}

#### mobile.html

<!-- THIS IS THE STANDARD HTML FOR MOBILE DEVICES -->

<!-- Load in the static function -->

{% load static %}

<!-- declare the DOCTYPE and html language-->

<!DOCTYPE html>

<html lang="en">

<!-- Create the head -->

<head>

<!-- Create a title using a block -->

<!-- This title needs to be changed! The best way to change the title

is in the other html files witch extends this html -->

<title>{% block title %} My Base Template{% endblock %}</title>

<!-- Use the mobile.css style sheet for all mobile layouts -->

<link rel="style sheet" type="text/css" href="{% static "assets/css/mobile.css" %}">

<!-- end of the head -->

</head>

<!-- Create the body -->

<body>

<!-- Create a page -->

<div id="page">

<!-- Create a logo block, using the logo layout from mobile.css -->

<div id="logo">

{% block logo %}

<!-- Place the Naturalis logo inside the logo block -->

<ul>

<a href="<http://www.naturalis.nl>"><img src="{% static "assets/images/Naturalis\_logo.png" %}" width="250"/></a>

</ul>

<!-- End of the logo block -->

{% endblock %}

</div>

<!-- Create a content block, using the content layout from mobile.css -->

<div id="content">

<!-- Place a standard text in the content -->

<!-- This block will be override for all mobile html pages -->

{% block content %}This is the content of this block{% endblock %}

</div>

<!-- Create a footer block, using the footer layout from mobile.css -->

<div id="footer">

<!-- Place some text in the footer block -->

{% block footer %}<p>&copy;2013-2014 Patrick Wijntjes</p>{% endblock %}

<!-- End of the page -->

</div>

<!-- End of the body and of the html -->

</body>

</html>

### Perl

#### classify.pl [19]

#!/usr/bin/perl

use strict;

use warnings;

use Getopt::Long;

use Data::Dumper;

use AI::FANN ':all';

use Fingerprint 'make\_fingerprint';

use Bio::Phylo::Util::Logger ':levels';

# process command line arguments

my $verbosity = WARN;

my $resolution = 50;

my $dir;

my $ai;

GetOptions(

'verbose+' => \$verbosity,

'dir=s' => \$dir,

'ai=s' => \$ai,

'resolution=i' => \$resolution,

);

# instantiate helper objects

my $log = Bio::Phylo::Util::Logger->new(

'-level' => $verbosity,

'-class' => 'main',

);

$log->info("going to instantiate AI from file $ai");

my $ann = AI::FANN->new\_from\_file($ai);

# read from the directory

$log->info("going to classify images in dir $dir");

opendir my $dh, $dir or die $!;

while( my $entry = readdir $dh ) {

if ( $entry =~ /.png$/ ) {

$log->debug("going to classify $entry");

# analyse the input file

my @fingerprint = make\_fingerprint(

'file' => "$dir/$entry",

'resolution' => $resolution,

);

$log->debug("made fingerprint of file");

# do the classification

my $result = $ann->run(\@fingerprint);

print "Entry: $entry\n";

print Dumper($result);

}

}

#### splitter.pl [19]

#!/usr/bin/perl

use strict;

use warnings;

use Data::Dumper;

use Getopt::Long;

use Image::Magick;

use List::Util 'sum';

use Bio::Phylo::Util::Logger ':levels';

# will have deep recursions

no warnings 'recursion';

# process command line arguments

my $threshold = 0.7;

my $fuzzyness = 100; # pixels

my $verbosity = WARN;

my $infile;

GetOptions(

'threshold=f' => \$threshold,

'fuzzyness=i' => \$fuzzyness,

'verbose+' => \$verbosity,

'infile=s' => \$infile,

);

# instantiate helper objects

my $log = Bio::Phylo::Util::Logger->new(

'-level' => $verbosity,

'-class' => 'main',

);

my $img = Image::Magick->new;

my %seen;

my %area;

# read the image

$log->info("going to read image '$infile'");

my $msg = $img->Read($infile);

$log->warn($msg) if $msg;

# get width and height

my $width = $img->Get('columns');

my $height = $img->Get('rows');

$log->info("width: $width height: $height");

# iterate over all pixels

for my $x ( 0 .. $width ) {

for my $y ( 0 .. $height ) {

my $nucleus = "$x,$y";

recurse( 'x' => $x, 'y' => $y, 'nucleus' => $nucleus );

if ( $area{$nucleus} ) {

my $size = scalar @{ $area{$nucleus} };

if ( $size > $fuzzyness ) {

$log->info("found area of $size pixels around nucleus $nucleus");

}

}

}

}

# write large areas

for my $nucleus ( grep { scalar @{ $area{$\_} } > $fuzzyness } keys %area ) {

my ($min\_x) = sort { $a <=> $b } map { [ split(/,/, $\_) ]->[0] } @{ $area{$nucleus} };

my ($max\_x) = sort { $b <=> $a } map { [ split(/,/, $\_) ]->[0] } @{ $area{$nucleus} };

my ($min\_y) = sort { $a <=> $b } map { [ split(/,/, $\_) ]->[1] } @{ $area{$nucleus} };

my ($max\_y) = sort { $b <=> $a } map { [ split(/,/, $\_) ]->[1] } @{ $area{$nucleus} };

# compute new area

my $new\_width = $max\_x - $min\_x;

my $new\_height = $max\_y - $min\_y;

$log->info("going to write $nucleus to ${new\_width}x${new\_height} file");

# create new image, set dimensions, make white background

my $new\_img = Image::Magick->new( 'size' => "${new\_width}x${new\_height}" );

$msg = $new\_img->Read('xc:white');

$log->warn($msg) if $msg;

$log->info("instantiated new image");

# assign pixels

for my $x ( 0 .. $new\_width ) {

for my $y ( 0 .. $new\_height ) {

my $loc = ( $x + $min\_x ) . ',' . ( $y + $min\_y );

if ( $seen{$loc} ) {

$msg = $new\_img->SetPixel( 'x' => $x, 'y' => $y, 'color' => $seen{$loc} );

$log->warn($msg) if $msg;

}

}

}

$log->info("assigned new pixels");

# write image

$msg = $new\_img->Write("${nucleus}.png");

$log->warn($msg) if $msg;

$log->info("wrote image ${nucleus}.png");

}

sub recurse {

my %args = @\_;

# get sub args

my $nucleus = delete $args{nucleus};

my ( $x, $y ) = @args{qw(x y)};

# sample the focal pixel

my @pixel = $img->GetPixel(%args);

# if pixel is darker than threshold and not yet seen...

if ( sum(@pixel)/scalar(@pixel) < $threshold && ! $seen{"$x,$y"} ) {

$log->debug("$x,$y");

# store the pixel

$seen{"$x,$y"} = \@pixel;

# initialize area around current nucleus

$area{$nucleus} = [] if not $area{$nucleus};

# store id of the focal pixel

push @{ $area{$nucleus} }, "$x,$y";

# start growing the area

if ( $x > 0 ) {

recurse( 'x' => $x - 1, 'y' => $y, 'nucleus' => $nucleus );

}

if ( $y > 0 ) {

recurse( 'x' => $x, 'y' => $y - 1, 'nucleus' => $nucleus );

}

if ( $x < $width ) {

recurse( 'x' => $x + 1, 'y' => $y, 'nucleus' => $nucleus );

}

if ( $y < $height ) {

recurse( 'x' => $x, 'y' => $y + 1, 'nucleus' => $nucleus );

}

}

}

#### traindata.pl [19]

#!/usr/bin/perl

use strict;

use warnings;

use Getopt::Long;

use Fingerprint 'make\_fingerprint';

use Bio::Phylo::Util::Logger ':levels';

# process command line arguments

my $verbosity = WARN;

my $resolution = 50;

my $dir;

my $category;

GetOptions(

'category=i' => \$category,

'resolution=i' => \$resolution,

'dir=s' => \$dir,

'verbose+' => \$verbosity,

);

# instantiate helper objects

my $log = Bio::Phylo::Util::Logger->new(

'-level' => $verbosity,

'-class' => [ 'main', 'Fingerprint' ],

);

# print the header

print "image\t";

for my $axis ( qw(vert horiz) ) {

for my $color ( qw(red green blue) ) {

my $max = $axis eq 'horiz' ? $resolution / 2 : $resolution;

for my $i ( 1 .. $max ) {

print "${axis}.${color}.${i}\t";

}

}

}

print "category\n";

# start reading the images

$log->info("going to read images from $dir");

opendir my $dh, $dir or die $!;

while( my $entry = readdir $dh ) {

# only read png files created by splitter.pl

if ( $entry =~ /(\d+,\d+)\.png/ ) {

my $nucleus = $1;

my @row = ( $nucleus );

# read image

my $img = Image::Magick->new;

push @row, make\_fingerprint(

'file' => $dir . '/' . $entry,

'resolution' => $resolution,

);

$log->info("created fingerprint for $entry");

push @row, $category;

print join("\t", @row), "\n";

}

}

#### traindata2.pl [19]

#!/usr/bin/perl

use strict;

use warnings;

use Getopt::Long;

use Fingerprint 'make\_fingerprint';

use Bio::Phylo::Util::Logger ':levels';

# process command line arguments

my $verbosity = WARN;

my $resolution = 50;

my $dir;

my $category;

GetOptions(

'category=i' => \$category,

'resolution=i' => \$resolution,

'dir=s' => \$dir,

'verbose+' => \$verbosity,

);

# instantiate helper objects

my $log = Bio::Phylo::Util::Logger->new(

'-level' => $verbosity,

'-class' => [ 'main', 'Fingerprint' ],

);

# print the header

print "image\t";

for my $axis ( qw(vert horiz) ) {

for my $color ( qw(red green blue) ) {

my $max = $axis eq 'horiz' ? $resolution / 2 : $resolution;

for my $i ( 1 .. $max ) {

print "${axis}.${color}.${i}\t";

}

}

}

print "category\n";

# start reading the images

$log->info("going to read images from $dir");

opendir my $dh, $dir or die $!;

while( my $entry = readdir $dh ) {

# only read png files created by splitter.pl

if ( $entry =~ /(\d+,?\d\*)\.png/ ) {

my $nucleus = $1;

my @row = ( $nucleus );

# read image

my $img = Image::Magick->new;

push @row, make\_fingerprint(

'file' => $dir . '/' . $entry,

'resolution' => $resolution,

);

$log->info("created fingerprint for $entry");

push @row, $category;

print join("\t", @row), "\n";

}

}

### Python for training

#### Offlickr.py [18]

#!/usr/bin/python

# -\*- coding: utf-8 -\*-

# Offlickr

# Hugo Haas -- <mailto:hugo@larve.net> -- <http://larve.net/people/hugo/>

# Homepage: <http://larve.net/people/hugo/2005/12/offlickr/>

# License: GPLv2

#

# Daniel Drucker <[dmd@3e.org](mailto:dmd@3e.org)> contributed:

# \* wget patch

# \* backup of videos as well

# \* updated to Beej's Flickr API version 1.2 (required)

import sys

import libxml2

import urllib

import getopt

import time

import os.path

import threading

# Beej's Python Flickr API

# <http://beej.us/flickr/flickrapi/>

from flickrapi import FlickrAPI

import logging

\_\_version\_\_ = '0.22 - 2009-03-20'

maxTime = '9999999999'

# Gotten from Flickr

flickrAPIKey = '1391fcd0a9780b247cd6a101272acf71'

flickrSecret = 'fd221d0336de3b6d'

class Offlickr:

def \_\_init\_\_(

self,

key,

secret,

uid,

httplib=None,

dryrun=False,

verbose=False,

):

"""Instantiates an Offlickr object

An API key is needed, as well as an API secret and a user id."""

self.\_\_flickrAPIKey = key

self.\_\_flickrSecret = secret

self.\_\_httplib = httplib

# Get authentication token

# note we must explicitly select the xmlnode parser to be compatible with FlickrAPI 1.2

self.fapi = FlickrAPI(self.\_\_flickrAPIKey, self.\_\_flickrSecret,

format='xmlnode')

(token, frob) = self.fapi.get\_token\_part\_one()

if not token:

raw\_input('Press ENTER after you authorized this program')

self.fapi.get\_token\_part\_two((token, frob))

self.token = token

self.flickrUserId = uid

self.dryrun = dryrun

self.verbose = verbose

def \_\_testFailure(self, rsp):

"""Returns whether the previous call was successful"""

if rsp['stat'] == 'fail':

print 'Error!'

return True

else:

return False

def getPhotoList(self, dateLo, dateHi):

"""Returns a list of photo given a time frame"""

n = 0

flickr\_max = 500

photos = []

print 'Retrieving list of photos'

while True:

if self.verbose:

print 'Requesting a page...'

n = n + 1

rsp = self.fapi.photos\_search(

api\_key=self.\_\_flickrAPIKey,

auth\_token=self.token,

user\_id=self.flickrUserId,

per\_page=str(flickr\_max),

page=str(n),

min\_upload\_date=dateLo,

max\_upload\_date=dateHi,

#The next line is added by Patrick Wijntjes, 14-01-2014

privacy\_filter=5

)

if self.\_\_testFailure(rsp):

return None

if rsp.photos[0]['total'] == '0':

return None

photos += rsp.photos[0].photo

if self.verbose:

print ' %d photos so far' % len(photos)

if len(photos) >= int(rsp.photos[0]['total']):

break

return photos

def getGeotaggedPhotoList(self, dateLo, dateHi):

"""Returns a list of photo given a time frame"""

n = 0

flickr\_max = 500

photos = []

print 'Retrieving list of photos'

while True:

if self.verbose:

print 'Requesting a page...'

n = n + 1

rsp = \

self.fapi.photos\_getWithGeoData(api\_key=self.\_\_flickrAPIKey,

auth\_token=self.token, user\_id=self.flickrUserId,

per\_page=str(flickr\_max), page=str(n))

if self.\_\_testFailure(rsp):

return None

if rsp.photos[0]['total'] == '0':

return None

photos += rsp.photos[0].photo

if self.verbose:

print ' %d photos so far' % len(photos)

if len(photos) >= int(rsp.photos[0]['total']):

break

return photos

def getPhotoLocation(self, pid):

"""Returns a string containing location of a photo (in XML)"""

rsp = \

self.fapi.photos\_geo\_getLocation(api\_key=self.\_\_flickrAPIKey,

auth\_token=self.token, photo\_id=pid)

if self.\_\_testFailure(rsp):

return None

doc = libxml2.parseDoc(rsp.xml)

info = doc.xpathEval('/rsp/photo')[0].serialize()

doc.freeDoc()

return info

def getPhotoLocationPermission(self, pid):

"""Returns a string containing location permision for a photo (in XML)"""

rsp = \

self.fapi.photos\_geo\_getPerms(api\_key=self.\_\_flickrAPIKey,

auth\_token=self.token, photo\_id=pid)

if self.\_\_testFailure(rsp):

return None

doc = libxml2.parseDoc(rsp.xml)

info = doc.xpathEval('/rsp/perms')[0].serialize()

doc.freeDoc()

return info

def getPhotosetList(self):

"""Returns a list of photosets for a user"""

rsp = self.fapi.photosets\_getList(api\_key=self.\_\_flickrAPIKey,

auth\_token=self.token, user\_id=self.flickrUserId)

if self.\_\_testFailure(rsp):

return None

return rsp.photosets[0].photoset

def getPhotosetInfo(self, pid, method):

"""Returns a string containing information about a photoset (in XML)"""

rsp = method(api\_key=self.\_\_flickrAPIKey,

auth\_token=self.token, photoset\_id=pid)

if self.\_\_testFailure(rsp):

return None

doc = libxml2.parseDoc(rsp.xml)

info = doc.xpathEval('/rsp/photoset')[0].serialize()

doc.freeDoc()

return info

def getPhotoMetadata(self, pid):

"""Returns an array containing containing the photo metadata (as a string), and the format of the photo"""

if self.verbose:

print 'Requesting metadata for photo %s' % pid

rsp = self.fapi.photos\_getInfo(api\_key=self.\_\_flickrAPIKey,

auth\_token=self.token, photo\_id=pid)

if self.\_\_testFailure(rsp):

return None

doc = libxml2.parseDoc(rsp.xml)

metadata = doc.xpathEval('/rsp/photo')[0].serialize()

doc.freeDoc()

return [metadata, rsp.photo[0]['originalformat']]

def getPhotoComments(self, pid):

"""Returns an XML string containing the photo comments"""

if self.verbose:

print 'Requesting comments for photo %s' % pid

rsp = \

self.fapi.photos\_comments\_getList(api\_key=self.\_\_flickrAPIKey,

auth\_token=self.token, photo\_id=pid)

if self.\_\_testFailure(rsp):

return None

doc = libxml2.parseDoc(rsp.xml)

comments = doc.xpathEval('/rsp/comments')[0].serialize()

doc.freeDoc()

return comments

def getPhotoSizes(self, pid):

"""Returns a string with is a list of available sizes for a photo"""

rsp = self.fapi.photos\_getSizes(api\_key=self.\_\_flickrAPIKey,

auth\_token=self.token, photo\_id=pid)

if self.\_\_testFailure(rsp):

return None

return rsp

def getOriginalPhoto(self, pid):

"""Returns a URL which is the original photo, if it exists"""

source = None

rsp = self.getPhotoSizes(pid)

if rsp == None:

return None

for s in rsp.sizes[0].size:

if s['label'] == 'Original':

source = s['source']

for s in rsp.sizes[0].size:

if s['label'] == 'Video Original':

source = s['source']

return [source, s['label'] == 'Video Original']

def \_\_downloadReportHook(

self,

count,

blockSize,

totalSize,

):

if not self.\_\_verbose:

return

p = ((100 \* count) \* blockSize) / totalSize

if p > 100:

p = 100

print '\r %3d %%' % p,

sys.stdout.flush()

def downloadURL(

self,

url,

target,

filename,

verbose=False,

):

"""Saves a photo in a file"""

if self.dryrun:

return

self.\_\_verbose = verbose

tmpfile = '%s/%s.TMP' % (target, filename)

if self.\_\_httplib == 'wget':

cmd = 'wget -q -t 0 -T 120 -w 10 -c -O %s %s' % (tmpfile,

url)

os.system(cmd)

else:

urllib.urlretrieve(url, tmpfile,

reporthook=self.\_\_downloadReportHook)

os.rename(tmpfile, '%s/%s' % (target, filename))

def usage():

"""Command line interface usage"""

print 'Usage: Offlickr.py -i <flickr Id>'

print 'Backs up Flickr photos and metadata'

print 'Options:'

print '\t-f <date>\tbeginning of the date range'

print '\t\t\t(default: since you started using Flickr)'

print '\t-t <date>\tend of the date range'

print '\t\t\t(default: until now)'

print '\t-d <dir>\tdirectory for saving files (default: ./dst)'

print '\t-l <level>\tlevels of directory hashes (default: 0)'

print '\t-p\t\tback up photos in addition to photo metadata'

print '\t-n\t\tdo not redownload anything which has already been downloaded (only jpg checked)'

print '\t-o\t\toverwrite photo, even if it already exists'

print '\t-L\t\tback up human-readable photo locations and permissions to separate files'

print '\t-s\t\tback up all photosets (time range is ignored)'

print '\t-w\t\tuse wget instead of internal Python HTTP library'

print '\t-c <threads>\tnumber of threads to run to backup photos (default: 1)'

print '\t-v\t\tverbose output'

print '\t-N\t\tdry run'

print '\t-h\t\tthis help message'

print '\nDates are specified in seconds since the Epoch (00:00:00 UTC, January 1, 1970).'

print '\nVersion ' + \_\_version\_\_

def fileWrite(

dryrun,

directory,

filename,

string,

):

"""Write a string into a file"""

if dryrun:

return

if not os.access(directory, os.F\_OK):

os.makedirs(directory)

f = open(directory + '/' + filename, 'w')

f.write(string)

f.close()

print 'Written as', filename

class photoBackupThread(threading.Thread):

def \_\_init\_\_(

self,

sem,

i,

total,

id,

title,

offlickr,

target,

hash\_level,

getPhotos,

doNotRedownload,

overwritePhotos,

):

self.sem = sem

self.i = i

self.total = total

self.id = id

self.title = title

self.offlickr = offlickr

self.target = target

self.hash\_level = hash\_level

self.getPhotos = getPhotos

self.doNotRedownload = doNotRedownload

self.overwritePhotos = overwritePhotos

threading.Thread.\_\_init\_\_(self)

def run(self):

backupPhoto(

self.i,

self.total,

self.id,

self.title,

self.target,

self.hash\_level,

self.offlickr,

self.doNotRedownload,

self.getPhotos,

self.overwritePhotos,

)

self.sem.release()

def backupPhoto(

i,

total,

id,

title,

target,

hash\_level,

offlickr,

doNotRedownload,

getPhotos,

overwritePhotos,

):

print str(i) + '/' + str(total) + ': ' + id + ': '\

+ title.encode('utf-8')

td = target\_dir(target, hash\_level, id)

if doNotRedownload and os.path.isfile(td + '/' + id + '.xml')\

and os.path.isfile(td + '/' + id + '-comments.xml')\

and (not getPhotos or getPhotos and os.path.isfile(td + '/'

+ id + '.jpg')):

print 'Photo %s already downloaded; continuing' % id

return

# Get Metadata

metadataResults = offlickr.getPhotoMetadata(id)

if metadataResults == None:

print 'Failed!'

sys.exit(2)

metadata = metadataResults[0]

format = metadataResults[1]

t\_dir = target\_dir(target, hash\_level, id)

# Write metadata

fileWrite(offlickr.dryrun, t\_dir, id + '.xml', metadata)

#The following lines were commented out by Patrick Wijntjes, 14-01-2014

'''# Get comments

photoComments = offlickr.getPhotoComments(id)

fileWrite(offlickr.dryrun, t\_dir, id + '-comments.xml',

photoComments)'''

# Do we want the picture too?

if not getPhotos:

return

[source, isVideo] = offlickr.getOriginalPhoto(id)

if source == None:

print 'Oopsie, no photo found'

return

# if it's a Video, we cannot trust the format that getInfo told us.

# we have to make an extra round trip to grab the Content-Disposition

isPrivateFailure = False

if isVideo:

sourceconnection = urllib.urlopen(source)

try:

format = sourceconnection.headers['Content-Disposition'].split('.')[-1].rstrip('"')

except:

print 'warning: private videos cannot be backed up due to a Flickr bug'

format = 'privateVideofailure'

isPrivateFailure = True

filename = id + '.' + format

if os.path.isfile('%s/%s' % (t\_dir, filename))\

and not overwritePhotos:

print '%s already downloaded... continuing' % filename

return

if not isPrivateFailure:

print 'Retrieving ' + source + ' as ' + filename

offlickr.downloadURL(source, t\_dir, filename, verbose=True)

print 'Done downloading %s' % filename

def backupPhotos(

threads,

offlickr,

target,

hash\_level,

dateLo,

dateHi,

getPhotos,

doNotRedownload,

overwritePhotos,

):

"""Back photos up for a particular time range"""

if dateHi == maxTime:

t = time.time()

print 'For incremental backups, the current time is %.0f' % t

print "You can rerun the program with '-f %.0f'" % t

photos = offlickr.getPhotoList(dateLo, dateHi)

if photos == None:

print 'No photos found'

sys.exit(1)

total = len(photos)

print 'Backing up', total, 'photos'

if threads > 1:

concurrentThreads = threading.Semaphore(threads)

i = 0

for p in photos:

i = i + 1

pid = str(int(p['id'])) # Making sure we don't have weird things here

if threads > 1:

concurrentThreads.acquire()

downloader = photoBackupThread(

concurrentThreads,

i,

total,

pid,

p['title'],

offlickr,

target,

hash\_level,

getPhotos,

doNotRedownload,

overwritePhotos,

)

downloader.start()

else:

backupPhoto(

i,

total,

pid,

p['title'],

target,

hash\_level,

offlickr,

doNotRedownload,

getPhotos,

overwritePhotos,

)

def backupLocation(

threads,

offlickr,

target,

hash\_level,

dateLo,

dateHi,

doNotRedownload,

):

"""Back photo locations up for a particular time range"""

if dateHi == maxTime:

t = time.time()

print 'For incremental backups, the current time is %.0f' % t

print "You can rerun the program with '-f %.0f'" % t

photos = offlickr.getGeotaggedPhotoList(dateLo, dateHi)

if photos == None:

print 'No photos found'

sys.exit(1)

total = len(photos)

print 'Backing up', total, 'photo locations'

i = 0

for p in photos:

i = i + 1

pid = str(int(p['id'])) # Making sure we don't have weird things here

td = target\_dir(target, hash\_level, pid) + '/'

if doNotRedownload and os.path.isfile(td + pid + '-location.xml'

) and os.path.isfile(td + pid

+ '-location-permissions.xml'):

print pid + ': Already there'

continue

location = offlickr.getPhotoLocation(pid)

if location == None:

print 'Failed!'

else:

fileWrite(offlickr.dryrun, target\_dir(target, hash\_level,

pid), pid + '-location.xml', location)

locationPermission = offlickr.getPhotoLocationPermission(pid)

if locationPermission == None:

print 'Failed!'

else:

fileWrite(offlickr.dryrun, target\_dir(target, hash\_level,

pid), pid + '-location-permissions.xml',

locationPermission)

def backupPhotosets(offlickr, target, hash\_level):

"""Back photosets up"""

photosets = offlickr.getPhotosetList()

if photosets == None:

print 'No photosets found'

sys.exit(0)

total = len(photosets)

print 'Backing up', total, 'photosets'

i = 0

for p in photosets:

i = i + 1

pid = str(int(p['id'])) # Making sure we don't have weird things here

print str(i) + '/' + str(total) + ': ' + pid + ': '\

+ p.title[0].text.encode('utf-8')

# Get Metadata

info = offlickr.getPhotosetInfo(pid,

offlickr.fapi.photosets\_getInfo)

if info == None:

print 'Failed!'

else:

fileWrite(offlickr.dryrun, target\_dir(target, hash\_level,

pid), 'set\_' + pid + '\_info.xml', info)

photos = offlickr.getPhotosetInfo(pid,

offlickr.fapi.photosets\_getPhotos)

if photos == None:

print 'Failed!'

else:

fileWrite(offlickr.dryrun, target\_dir(target, hash\_level,

pid), 'set\_' + pid + '\_photos.xml', photos)

# Do we want the picture too?

def target\_dir(target, hash\_level, id):

dir = target

i = 1

while i <= hash\_level:

dir = dir + '/' + id[len(id) - i]

i = i + 1

return dir

def main():

"""Command-line interface"""

# Default options

flickrUserId = None

dateLo = '1'

dateHi = maxTime

getPhotos = False

overwritePhotos = False

doNotRedownload = False

target = 'dst'

photoLocations = False

photosets = False

verbose = False

threads = 1

httplib = None

hash\_level = 0

dryrun = False

# Parse command line

try:

(opts, args) = getopt.getopt(sys.argv[1:],

'hvponNLswf:t:d:i:c:l:', ['help'])

except getopt.GetoptError:

usage()

sys.exit(2)

for (o, a) in opts:

if o in ('-h', '--help'):

usage()

sys.exit(0)

if o == '-i':

flickrUserId = a

if o == '-p':

getPhotos = True

if o == '-o':

overwritePhotos = True

if o == '-n':

doNotRedownload = True

if o == '-L':

photoLocations = True

if o == '-s':

photosets = True

if o == '-f':

dateLo = a

if o == '-t':

dateHi = a

if o == '-d':

target = a

if o == '-w':

httplib = 'wget'

if o == '-c':

threads = int(a)

if o == '-l':

hash\_level = int(a)

if o == '-N':

dryrun = True

if o == '-v':

verbose = True

# Check that we have a user id specified

if flickrUserId == None:

print 'You need to specify a Flickr Id'

sys.exit(1)

# Check that the target directory exists

if not os.path.isdir(target):

print target + ' is not a directory; please fix that.'

sys.exit(1)

offlickr = Offlickr(

flickrAPIKey,

flickrSecret,

flickrUserId,

httplib,

dryrun,

verbose,

)

if photosets:

backupPhotosets(offlickr, target, hash\_level)

elif photoLocations:

backupLocation(

threads,

offlickr,

target,

hash\_level,

dateLo,

dateHi,

doNotRedownload,

)

else:

backupPhotos(

threads,

offlickr,

target,

hash\_level,

dateLo,

dateHi,

getPhotos,

doNotRedownload,

overwritePhotos,

)

if \_\_name\_\_ == '\_\_main\_\_':

main()

#### get\_tags.py

import os

#Open a in read mode

files = open("a", 'r')

#Create a list of all the xml files

infiles = files.readlines()

#Close and remove the temporary file

files.close()

#Loop through the list

for x in infiles:

#Remove all enters at the back of the filename

infile = x.strip()

#Get the picture id, to save the tags with the same number as the picture

#Example the name of the meta file is 123456789.xml so the id is 123456789

number = infile.split(".")[0]

#Print a message

print "Collecting the tags of file %s"%(infile)

#Open the meta data file in read mode

open\_file = open(infile, 'r')

#Make a list of the meta data

read\_file = open\_file.readlines()

#Try to find the tags

try:

'''One line before the first tag you can find "/t<tags>\n"

So the first tag will be the index of "/t<tags>\n" +1'''

#Get the index of the first tag

start = read\_file.index("\t<tags>\n") +1

'''One line after the last tag you can find "\t</tags>\n"

So the last tag will be the index of "/t</tags>\n" -1. Since a for-loop

loops from start to end, EXCLUDING the end, you use the index of "/t</tags>\n"'''

#Get the index of the end of the tags

end = read\_file.index("\t</tags>\n")

#Get the original name of the picture

title = read\_file[2].split(">")[1].split("<")[0]

#print title

#Save the output name (using the id of the picture)

out\_name = "%s\_tags.txt"%(number)

#Open the output file in write mode

output = open(out\_name, 'w')

print "The tags will be saved in %s"%(out\_name)

#Write the name of the picture and a white line to the output file

#The title will always be the first line of the output file

output.write("%s\n\n"%(title))

#Loop through the tags

for y in range(start, end):

#print read\_file[y].strip().split(" ")[3].split('"')[1]

#Write the text between <tag> and </tag> to the output file

output.write(read\_file[y].strip().split(" ")[3].split('"')[1])

#Write an enter to the output file

output.write("\n")

#When the loop ends, close the output file

output.close()

'''If there are no tags, a ValueError arise. Except this Error and print

a message that the file has no tags'''

except ValueError:

print "%s has no tags"%(infile)

#Close the output file

open\_file.close()

#break

#### add\_columns.py

import os

#Collect all tsv files and save the names in files.txt

os.system("ls | egrep '.tsv' > files.txt")

#Read the names of the tsv files and save them as a list in python

files = open("files.txt", 'r').readlines()

#Create variables

number = len(files)

header = []

out = []

counter = 0

maxi = 0

#Get the path working directory

path = os.path.dirname(os.path.realpath("add\_columns.py"))

#The output file for the lenght will named as the directory

file = path.split("/")[-1] + ".txt"

lenght = open(file, 'w')

#add information to the output lists

for q in range(number):

out.append(0)

header.append("C%s"%(q+1))

#Loop through the list of files

for x in range(number):

#print "file:", files[x].strip()

#Create an output file

y = files[x].strip()

name = y.split(".")[0] + "\_new.tsv"

output = open(name, 'a')

#Read the content of the file, save it as a list

z = open(y, 'r').readlines()

#Loop through the list of content

for a in range(len(z)):

#Create variables, b is the content list, i is the output list

b = z[a].split("\t")

i = b

#When a is 0, it is the header

if a == 0:

#Add the header list to the output list

for c in range(number):

i.append(header[c])

#Write the content of the output list to the output file

for d in i:

output.write(d.strip() + "\t")

#After looping through the output list write an enter to the output file.

output.write("\n")

#When a is not 0 it is a normal line

else:

#When the counter (=file number) is equal to x, column x gets an 1

if counter == x:

out[x] = 1

#Otherwise it keeps a 0

else:

pass

#Change the last column (=catagory) from a zero with an enter to a zero without an enter

i[-1] = 0

#Add the list of 0's (and 1's for column x == counter) to the output list

for f in range(number):

i.append(out[f])

#Write the contentn of the output list to the output file

for g in i:

output.write("%s\t" %(g))

#After looping through the output list write an enter to the output file.

output.write("\n")

#print "lengte: ", len(i)

#Search to the hights number of columns

if maxi < len(i):

maxi = len(i)

#Set the column with 1 back to 0 for the next file

out[x] = 0

#Add 1 to the counter.

counter += 1

#os.system("rm %s"%(y))

#Close the output file

output.close()

#Remove the temporary file

os.system("rm files.txt")

#print "Maxi:", maxi

#Writhe the highest number of columns to the lenght output file

lenght.write("%s"% (maxi))

#Close the lenght output file

lenght.close()

#Move the output file out the Flower directory

os.system("mv %s ../"%(file))

#### combine\_files.py

import os

#Save all tsv files created with add\_columns.py in files.txt

os.system("ls | egrep 'new' > files.txt")

#Read the content of files.txt and save it as a list

files = open('files.txt', 'r').readlines()

#Create variables

number = len(files)

counter = 0

#Get the path working directory

paht = os.path.dirname(os.path.realpath("combine\_files.py"))

#The output file will named as the directory

name = paht.split("/")[-1] + ".tsv"

#print name

output = open(name, 'a')

#Loop through the files list

for x in range(number):

y = files[x].strip()

#print "file:", y

#Read the content of the file, save it as a list.

z = open(y, 'r').readlines()

#Loop through the lines

for a in range(len(z)):

#create a list, every columns is an entry of the list

b = z[a].split("\t")

#When counter is 0, this is the first file.

if counter == 0:

#The whole content of the file is written to the output file

for d in b:

output.write(d.strip() + "\t")

#After looping through the content, write an enter

output.write("\n")

#When counter isn't 0, it is not the first file

else:

#When a is 0 it is the header

if a == 0:

#The header will not be written to the output file, because it is already there

pass

#When a isn't 0 it is not the header

else:

#The content will be written to the output file

for d in b:

output.write(d.strip() + "\t")

#After looping through the content, write an enter to the output file.

output.write("\n")

#Add 1 to the counter

counter += 1

#os.system("rm %s"%(y))

#Close the output file

output.close()

#Remove the temporary files.txt file

os.system("rm files.txt")

#Move the output file out of the Flower directory

os.system("mv %s ../"%(name))

#### complete\_columns.py

import os

#Save a list of the length files in len\_files

os.system("ls | egrep '.txt' > len\_files")

#Read the content of len\_files and save it as a list

len\_files = open('len\_files', 'r').readlines()

#Create variables

name\_list = []

names = []

max = 0

infile = ''

##print len\_files

#Loop through the len\_files and add the content to the list.

for x in len\_files:

name\_list.append(x.strip())

##print name\_list

#Loop through the name\_list

for y in name\_list:

#Read the lenth of from the file

file = int(open(y, 'r').readline())

## print file

#Find the maximum lenth

if max < file:

max = file

#Save the name of the file with the maximum lenth

infile = y

#print "Max:", max

#print "infile:", infile

##print "1:", name\_list

#Remove the file wiht the maximum lenght from the name\_list

name\_list.remove(infile)

# name\_list contains only the files that needs to be extended

##print "2:", name\_list

#Loop through the name list

for z in name\_list:

#Add the names of the tsv files to the names list.

name = z.split(".")[0] + ".tsv"

names.append(name)

# Dit zijn de echte files die aangevuld moeten worden.

#print names

#Loop through the names list

for a in names:

## print "----------------------------------------------"

#Read the content of the file and save it as a list

content = open(a, 'r').readlines()

#Loop through the content

for c in range(len(content)):

#When c is zero it is the header line

if c == 0:

#Save the header as list

header = content[c].split("\t")

#Remove the empty field and the enter from the header

header.pop(-1)

header.pop(-1)

#Save the lenth of the header line (= number of columns)

file\_length = int(len(header))

## print file\_length

#Calculate the difference between the max lenght and the lenth of the current file

difference = max-file\_length

## print difference

## print header[-1]

#Save the C-number of the last column

number = int(header[-1].split("C")[1])

#Create an output file

outname = "%s\_new.tsv" %(a.split(".")[0])

#print outname

output = open(outname, 'w')

#Use the difference to add information to the header list

for q in range(difference):

adding = "C" + str(number + q + 1)

header.append(adding)

#Write the content of the header list to the output file

for i in header:

output.write("%s\t"%(i))

#After looping through the header list, write an enter to the output file

output.write("\n")

#Close the output file

output.close()

#When c is not zero, it is not the header line

else:

# save the content of the line as a list.

line = content[c].split("\t")

#Remove the empty field and the enter from the header

line.pop(-1)

line.pop(-1)

#Save the lenth of the line (= number of columns)

file\_length = int(len(line))

#Calculate the difference between the max lenght and the lenth of the current file

difference = max-file\_length

#Open the output file again, using the append mode

outname = "%s\_new.tsv" %(a.split(".")[0])

## print outname

output = open(outname, 'a')

#Use a the difference to add enough 0's

for v in range(difference):

line.append(0)

#Write the content of the line list to the output file

for w in line:

output.write("%s\t"%(w))

#After looping through the line list, write an enter to the output file

output.write("\n")

#Close the output file

output.close()

#print "mv %s %s"%(outname, a)

#Rename the output file

os.system("mv %s %s"%(outname, a))

#Remove the temporary len\_files file

os.system("rm len\_files")

### Python for website

#### forms.py

# Import the required modules

from django import forms

from models import Orchid

# Class for uploading pictures

class UploadPictureForm(forms.ModelForm):

# The meta data

class Meta:

# The used model, Orchids in this case

model = Orchid

#### views.py

# import the required modules

from django.http import HttpResponseRedirect

from django.shortcuts import render\_to\_response

from forms import UploadPictureForm

from django.core.context\_processors import csrf

from django.contrib import auth

from time import time

from django.contrib.auth.decorators import login\_required

import os

# Function to get the used devise.

def get\_device( request ):

""" Redirect to the servers list. """

#Initiate the device variable

device = ""

#If the used device is in the list, the device is a mobile phone

'''I have test both html-styles on the iPad. The results shows that the iPad can

better show the computer style'''

if 'HTTP\_USER\_AGENT' in request.META and (

request.META['HTTP\_USER\_AGENT'].startswith( 'BlackBerry' ) or \

"Opera Mobi" in request.META.get('HTTP\_USER\_AGENT') or \

"Opera Mini" in request.META.get('HTTP\_USER\_AGENT') or \

"Windows CE" in request.META.get('HTTP\_USER\_AGENT') or \

"MIDP" in request.META.get('HTTP\_USER\_AGENT') or \

"Palm" in request.META.get('HTTP\_USER\_AGENT') or \

"NetFront" in request.META.get('HTTP\_USER\_AGENT') or \

"Nokia" in request.META.get('HTTP\_USER\_AGENT') or \

"Symbian" in request.META.get('HTTP\_USER\_AGENT') or \

"UP.Browser" in request.META.get('HTTP\_USER\_AGENT') or \

"UP.Link" in request.META.get('HTTP\_USER\_AGENT') or \

"WinWAP" in request.META.get('HTTP\_USER\_AGENT') or \

"Android" in request.META.get('HTTP\_USER\_AGENT') or \

"DoCoMo" in request.META.get('HTTP\_USER\_AGENT') or \

"KDDI-" in request.META.get('HTTP\_USER\_AGENT') or \

"Softbank" in request.META.get('HTTP\_USER\_AGENT') or \

"J-Phone" in request.META.get('HTTP\_USER\_AGENT') or \

"IEMobile" in request.META.get('HTTP\_USER\_AGENT') or \

"iPod" in request.META.get('HTTP\_USER\_AGENT') or \

"iPhone" in request.META.get('HTTP\_USER\_AGENT') ):

device = "mobile"

#Otherwise it is a computer.

else:

device = "computer"

#Return the device

return device

def check\_upload(upload):

picture = ["jpg","tif","bmp","gif","png","jpeg","psd","pspimage","thm","yuv"]

name = str(upload)

extension = name.lower().split(".")[-1]

if extension in picture:

return True

else:

name = name.replace(" ","\ ")

os.system("rm static/uploaded\_files/%s"%(name))

return False

# Welcome view (homepage)

def welcome(request):

#Get the used device, using the get\_device function

device = get\_device(request)

# Create the args dictionary and save the csrf in this dictonary

args = {}

args.update(csrf(request))

# ONLY FOR TESTING! Save the device in the args dictionary

args['device']=device

# Save the html name, with the used device

html = device+"\_welcome.html"

# Call the html, for the correct device, for de welcome page.

return render\_to\_response(html, args)

#Function to give the uploaded file a variable part in front of the filename

def processUpload(request, filename):

filename2 = str(filename).replace(" ","\_")

filename = str(filename).replace(" ","\ ")

# Get the IP-adres of the computer

x\_forwarded\_for = request.META.get('HTTP\_X\_FORWARDED\_FOR')

if x\_forwarded\_for:

ip = x\_forwarded\_for.split(',')[0]

else:

ip = request.META.get('REMOTE\_ADDR')

# Replace the '.' in the ip-adres to '\_'

ip = ip.replace('.', '\_')

# Create an output file named <ip>\_filename.txt

outfile = open('%s\_filename.txt' %(ip), 'w')

# Place the variable part (the ip) in front of the filename of the uploaded file

os.system("mv static/uploaded\_files/%s static/uploaded\_files/%s\_%s"%(filename, ip, filename2))

# Write the new filename to the outputfile

outfile.write("%s\_%s" %(ip, filename2))

# Close the outputfile

outfile.close()

# The upload view (choice file and upload it)

def upload(request):

#Get the used device, using the get\_device function

device = get\_device(request)

# Get the IP-adres of the computer

x\_forwarded\_for = request.META.get('HTTP\_X\_FORWARDED\_FOR')

if x\_forwarded\_for:

ip = x\_forwarded\_for.split(',')[0]

else:

ip = request.META.get('REMOTE\_ADDR')

# Replace the '.' in the ip-adres to '\_'

ip = ip.replace('.', '\_')

message = ""

style = ""

# Check if the method is POST

if request.method == 'POST':

message = "You didn't select a picture"

style = "color:red"

# Save the user input from the form

form = UploadPictureForm(request.POST, request.FILES)

# Check if the form is valid

if form.is\_valid():

# Save the form

form.save()

is\_picture = check\_upload(request.FILES["picture"])

if is\_picture:

# run the processUpload function to place the ip in front of the name of the uploaded file

processUpload(request, request.FILES["picture"]) # zie hier nog een extra regel

''' save the filename and path in python variables

use the variable part (the ip) to create the path'''

filename = str(request.FILES["picture"]).replace(" ", "\_")

path = ("static/assets/uploaded\_files/%s\_%s" % (ip, filename))

# Create the args dictionary and save the csrf in this dictonary

args = {}

args.update(csrf(request))

# save the filename and path in the dictionary

args['filename'] = filename

args['path'] = path

# Save the html name, whit the used device

html = device+"\_upload\_succes.html"

# Call the upload\_succes html, for the correct device and give it the args dictonary

return render\_to\_response(html, args)

else:

# Create the args dictionary and save the csrf in this dictonary

args = {}

args.update(csrf(request))

# Save the empty form in the dictionary

args['form'] = UploadPictureForm()

args['message'] = message

args['style'] = style

# Save the html name, with the used device

html = device+"\_upload.html"

# Call the upload html, for the correct device and give it the args dictionary

return render\_to\_response(html, args)

# When the method is not POST

else:

# Create a form to upload a picture

form = UploadPictureForm()

# Create the args dictionary and save the csrf in this dictonary

args = {}

args.update(csrf(request))

# Save the empty form in the dictionary

args['form'] = UploadPictureForm()

args['message'] = message

args['style'] = style

# Save the html name, with the used device

html = device+"\_upload.html"

# Call the upload html, for the correct device and give it the args dictionary

return render\_to\_response(html, args)

# The result view (to display the result of the analysis)

def result(request):

#Get the used device, using the get\_device function

device = get\_device(request)

try:

# Get the IP-adres of the computer

x\_forwarded\_for = request.META.get('HTTP\_X\_FORWARDED\_FOR')

if x\_forwarded\_for:

ip = x\_forwarded\_for.split(',')[0]

else:

ip = request.META.get('REMOTE\_ADDR')

# Replace the '.' in the ip-adres to '\_'

ip = ip.replace('.', '\_')

# Read in the filename from <ip>\_filename.txt

infile = open('%s\_filename.txt' %(ip), 'r')

filename = infile.read().strip()

# Close the infile

infile.close()

# Run the program to identify the orchid

# Warning: The program now used is only a test program!

os.system("python resultaat.py %s %s" % (filename, ip))

# Open the file with the results from the identify program

result = open('%s\_test.txt' %(ip), 'r')

# Read in the results

read\_result = result.read()

# Close the file

result.close()

# Create the args dictionary and save the csrf in this dictonary

args = {}

args.update(csrf(request))

# Save the filename and the result in the args dictionary

args['filename'] = filename

args['result'] = read\_result

# Save the html name with the used device

html = device+"\_result.html"

# Call the result html, for the correct device, with the args dictionary

return render\_to\_response(html, args)

except IOError:

'''If an IOError occure, the picture is uploaded just when the administrator removed all

unused files. So the uploaded picture is also removed. Send the user to the sorry page,

which tells the user to try uploading again.'''

# Save the html name with the used device

html = device+"\_sorry.html"

# Go to the sorry html, for the correct device

return render\_to\_response(html)

# The exit view (to "close" the app and remove all created temporary files)

def exit(request):

# Get the IP-adres of the computer

x\_forwarded\_for = request.META.get('HTTP\_X\_FORWARDED\_FOR')

if x\_forwarded\_for:

ip = x\_forwarded\_for.split(',')[0]

else:

ip = request.META.get('REMOTE\_ADDR')

# Replace the '.' in the ip-adres to '\_'

ip = ip.replace('.', '\_')

''' Create the variable part for the filename using a timestamp.

replace all . in \_ to prevent errors for the extension '''

var\_part = str(time()).replace('.', '\_')

# Read in the filename from <ip>\_filename.txt, save it and close the file

infile = open('%s\_filename.txt' %(ip), 'r')

filename = infile.read().strip()

infile.close()

# Remove the temporary file <ip>\_filename.txt

# Move the uploaded picture and its result to the result directory,

# Save it as timestamp\_ip.jpg and timestamp\_ip\_result.txt

os.system("rm %s\_filename.txt" %(ip))

os.system("mv static/uploaded\_files/%s results/%s\_%s.jpg" %(filename, var\_part, filename))

os.system("mv %s\_test.txt results/%s\_%s\_result.txt" %(ip, var\_part, ip))

# Go back to the welcome page

return HttpResponseRedirect('/welcome')

# To remove all leftover files, login is required

def login(request):

#Get the used device, using the get\_device function

device = get\_device(request)

# Create a dictionary and put the csrf in it

args = {}

args.update(csrf(request))

#Save the html name with the used device

html=device+"\_login.html"

#Go to the login html, for the correct device, give it the dictionary

return render\_to\_response(html, args)

# Function to check the username and password

def auth\_view(request):

# Get the username and password

username = request.POST.get('username', '')

password = request.POST.get('password', '')

''' If the username and password are incorrect user will be None

Otherwise it will be the user '''

user = auth.authenticate(username=username, password=password)

''' Go to the correct page (admin/remove for correct login, invalid for

invalid login)'''

if user is not None:

#Login the user

auth.login(request, user)

return HttpResponseRedirect('/admin/remove')

else:

return HttpResponseRedirect('/accounts/invalid')

# function for logout

def logout(request):

#Log the user out

auth.logout(request)

#Go back to the welcome page

return HttpResponseRedirect('/welcome/')

# Function for invalid login

def invalid\_login(request):

#Get the used device, using the get\_device function

device = get\_device(request)

# Go to the invalid login html, for the correct device

html = device+"\_invalid\_login.html"

return render\_to\_response(html)

@login\_required

#User need to be registreded. Even when the user is not active this user can login and remove the files.

def remove(request):

#Get the used device, using the get\_device function

device = get\_device(request)

# List all the files that will be removed using a command line command (ls)

'''Save the name(s) of the picture(s) that will be removed in uploads.txt and the

name(s) of the temporary file(s) in temps.txt'''

os.system("ls static/uploaded\_files > uploads.txt")

os.system("ls | egrep \*\_filename.txt > temps.txt")

#Remove all the unused pictures and their temporary files

os.system("rm static/uploaded\_files/\*")

os.system("rm \*filename.txt")

#Read the content of the uploads.txt file and the temps.txt file and save the content in

# Python variables

uploads\_in = open("uploads.txt", 'r')

temps\_in = open("temps.txt", 'r')

uploads = uploads\_in.read()

temps = temps\_in.read()

# Create the args dictionary and save the csrf in this dictonary

args = {}

args.update(csrf(request))

#Save the list of the pictures that will be removed in the dictionary

args['uploads'] = uploads

#Save the list of the temporary files that will be removed in the dictionary

args['temps'] = temps

# Remove the text files wich contain the lists

os.system("rm uploads.txt temps.txt")

# Save the html name with the used device

html = device+"\_remove.html"

# Call the html, for the correct device, and give it the args directory

return render\_to\_response(html, args)