



Version 2.0

User Manual

HORIBA


 **Fraunhofer**
IIS

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1. Installation

For installing *QSP2.0* use the provided *QSP2.0* installer:

 Horiba_QSP_2.0.1_Installer.exe

Click on <https://rebrand.ly/hormed-qsp> to get the QSP2.0 installer location.



Accept the license agreement and chose an installation directory.

It is not possible to have different versions installed side-by-side.

Before uninstalling *QSP* make sure all *QSP* applications are closed.



Installing *QSP* requires admin rights on the computer

2. User Account Concept

QSP is a desktop software that uses the concept of user accounts. They are different from the Microsoft Windows user accounts.

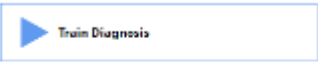










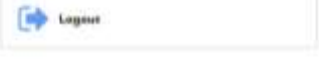

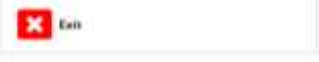
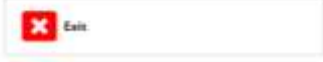
An account can have one of three Roles

- Assistant
- Expert
- Administrator

Typically, each installation of *QSP* will have a single Expert and a single Administrator account and one or more Assistant accounts.

Across the life cycle of *QSP*, the *Expert* user will add new *Slide Packages* frequently and double-check the pre-provided diagnosis. Then the new slides will be available to all *Assistant* users who can train by entering their own diagnosis, including classifying each individual cell. Assistants can evaluate themselves by comparing their diagnosis with the ground truth and store the evaluation in a PDF report or an Excel sheet.

The options available to the three user types are:

Assistant	Expert	Administrator
		
		
		
		
		
		

2.1. Role Assistant

An assistant can open a previously loaded *Slide Package* and diagnose the slides one by one. For slides that have been entirely diagnosed, the assistant can create the evaluation as well as an *Evaluation Report*.

An assistant cannot import new *Slide Packages* into *QSP* as the process of importing a new *Slide Package* involves double-checking the pre-provided diagnose, which is reserved for an *Expert* user.

2.2. Role Expert

An expert user can load new Slide Packages into *QSP*. Packages are provided by Horiba Medical. They contain a diagnose that includes a classification for every single cell. Nevertheless, upon importing the Slide Package, the expert is asked to sign-off on or, if necessary, correct the slides' cell classifications.

An expert can also create an *Evaluation Report* individually for each assistant user as well as an *Expert Evaluation Report* that contains statistics on all assistant users.

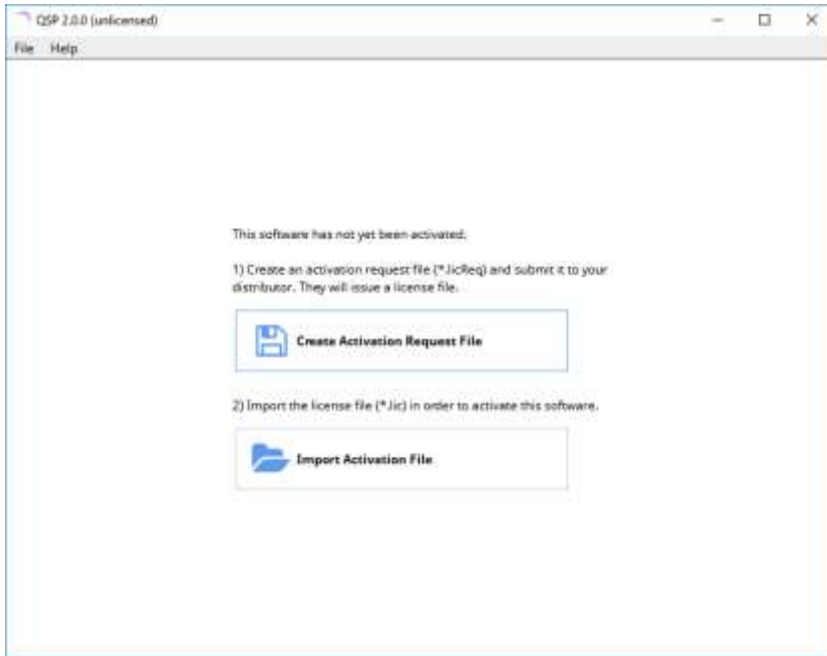
2.3. Role Administrator

Only the administrator account can access the program settings, where for instance the paths where imported slides are stored, can be configured.

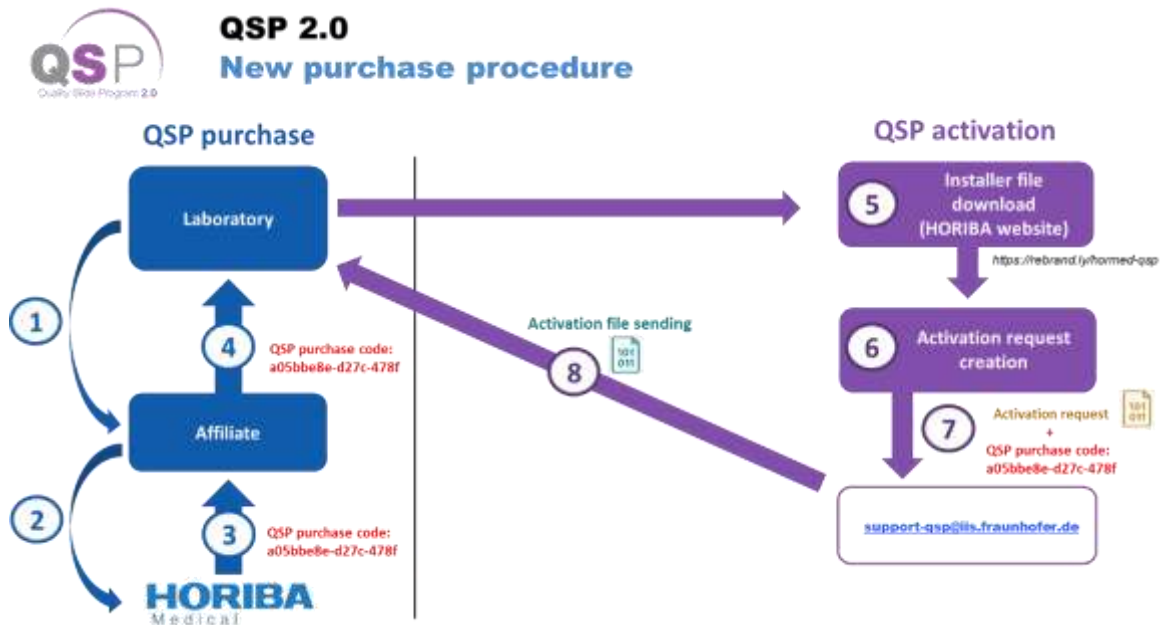
3. First Start

3.1. Activating QSP

QSP will check at every program start for a valid software license. When no such license is detected, QSP will not display the usual user login, but instead show two buttons to activate the software.



The activation procedure works as follows:



1. Please share “activation request file” generated in step 3.1 (*please see. “Activating QSP”*) along with QSP purchase code received from HORIBA Medical or associate at the time of purchase of QSP2.0 to support-qsp@iis.fraunhofer.de.

2. You will receive a file from support-qsp support-qsp@iis.fraunhofer.de email ID.
3. Please upload received file by “Import activation file” option.

3.1.1. Single License

The QSP single-license is a “node-locked” license, i.e. it is tied to a single computer based on the computer’s unique “fingerprint”. The single QSP installation can be shared by multiple Windows user accounts, though.

3.1.2. Site License

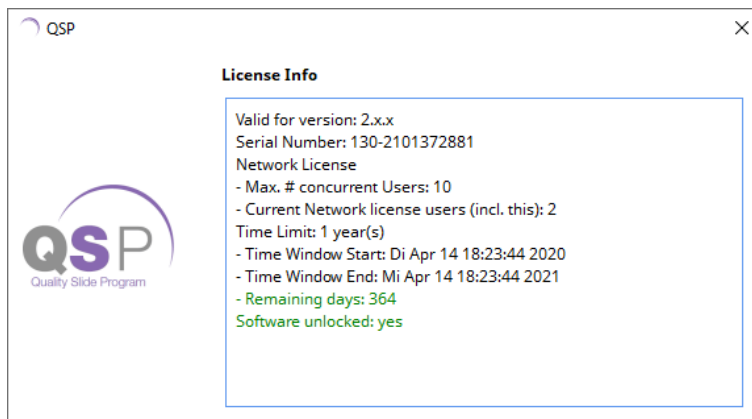
Alternatively, a “Site license” is available. A single computer will serve as a “License Server” and activated with a QSP site license, e.g. for 10 concurrent users.

Subsequently, QSP can be installed on any computer in the local network. At program start, QSP will automatically search for a “License Server” in the network and if one is found, use one of the 10 available slots. The local QSP installation does not have to be activated with a license file.

The first ten concurrent users can use QSP in this way. When the 11th parallel user starts QSP, they will see this message at program start:



Information on the current license can be accessed by pressing in the main menu “Help” | “License Information”.



3.1.3. Site License – License Server Installation

The process of importing the site license activation file is identical to the activation of a single license as described above.

- 1) Install QSP
- 2) Start QSP
- 3) Create activation request file
- 4) Import activation file. This file contains the information that it is a site license as well as the number of concurrent users

The computer has to remain switched on. Otherwise other computers in the local network will not be able to detect the site license. QSP itself does not have to be started. It is only used to import the activation file.

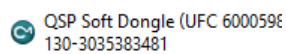
However, before the site license is found by other computers, the server has to be made “visible”:

- 5) In the Windows Start-Menu type “CodeMeter” and open the “CodeMeter Control Center”

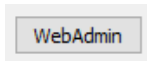


CodeMeter (by Wibu Systems) is the copy protection system built into QSP. It has been automatically installed as part of the QSP installation.

- 6) *CodeMeter Control Center* lists at least one entry related to QSP. The green icon indicates that a valid license has already been imported



Press the “WebAdmin” button in the bottom-right corner:



- 7) The *CodeMeter WebAdmin* website will be opened in the default web browser. Here, go to “Configuration” | “Server” and click “Enable” in the “Network Server” section.



- 8) Congratulations. Now QSPs running on other computers in the network will detect the site license.



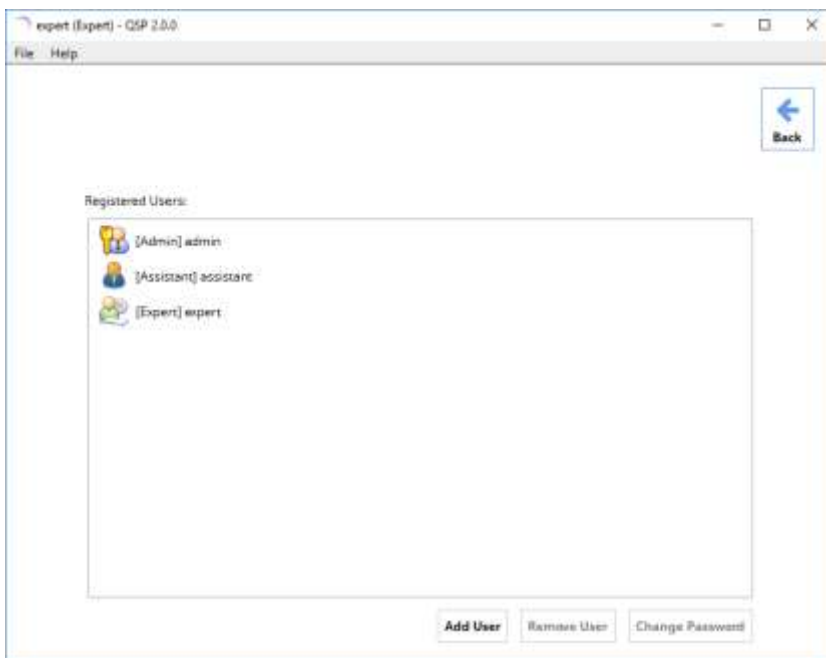
The site license will not be detected across a VPN remote connection. The license server has to be connected in the local LAN.

3.2. Setting up User Accounts

The Expert and Admin users can manage user accounts via the “Manage User Account” button in the main menu.



The “Manage User Account” view shows a list of all currently registered accounts.



By default, QSP has three pre-configured accounts, one for each role: *Assistant*, *Expert* and *Admin*:

Username	Role	Password
“assistant”	Assistant	“12”
“expert”	Expert	“12”
“admin”	Administrator	“12”

The default passwords should be changed by selecting an account and clicking the “Change Password” button. You will be prompted to enter the current password: type “12”. Afterwards you are asked to enter the new password twice.



The passwords cannot be reset in case they are forgotten, so make sure to store them safely.

New user accounts are created by clicking “Add User”. A dialog will pop up:



Select whether the new user is an *Expert* (select “ExpertAlias”) or an *Assistant*. Additional Administrator accounts cannot be created.

3.3. Adding a new Slide Package [Expert/Admin-only]

Loading a new *Slide Package* into QSP is only possible to users with the role *Expert*.

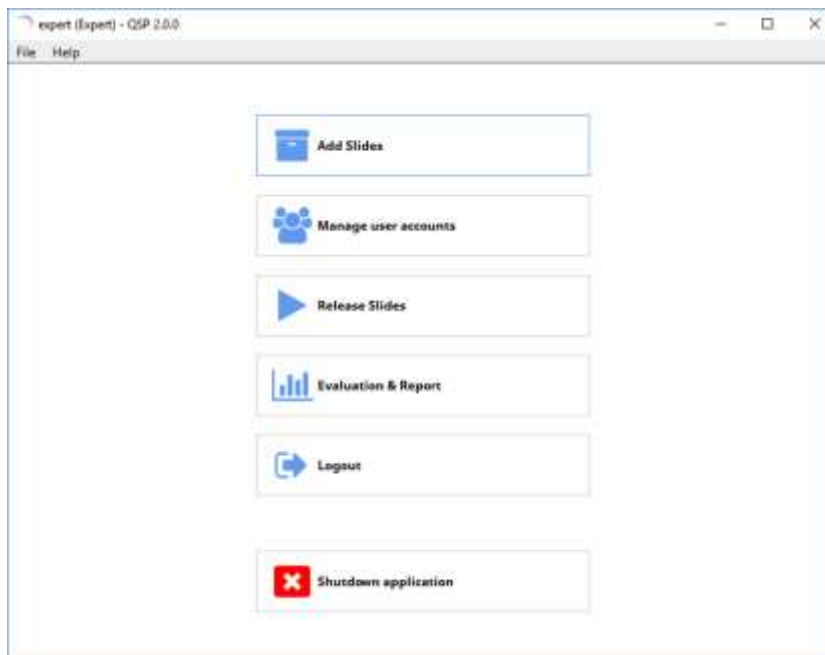
Packages are provided by Horiba Medical. They contain a diagnose that includes a classification for every single cell. Nevertheless, upon importing the *Slide Package*, the expert is asked to sign-off on or, if necessary, correct the slides’ cell classifications.

3.3.1. Download Slide Package from Horiba Medical website

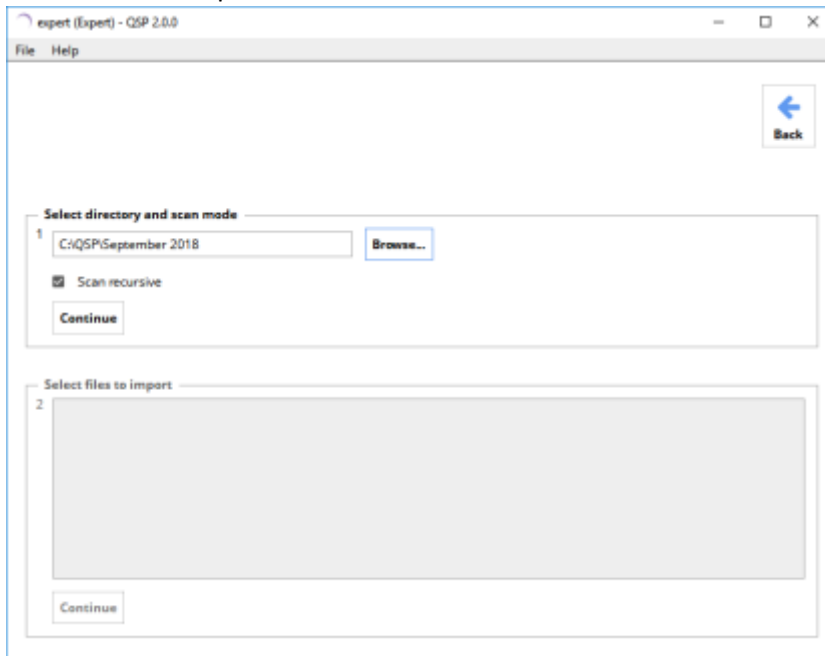
Slide Packages are provided monthly directly by Horiba Medical. An expert creates new Virtual Slides and pre-classifies all cells.

3.3.2. Import Slide into QSP

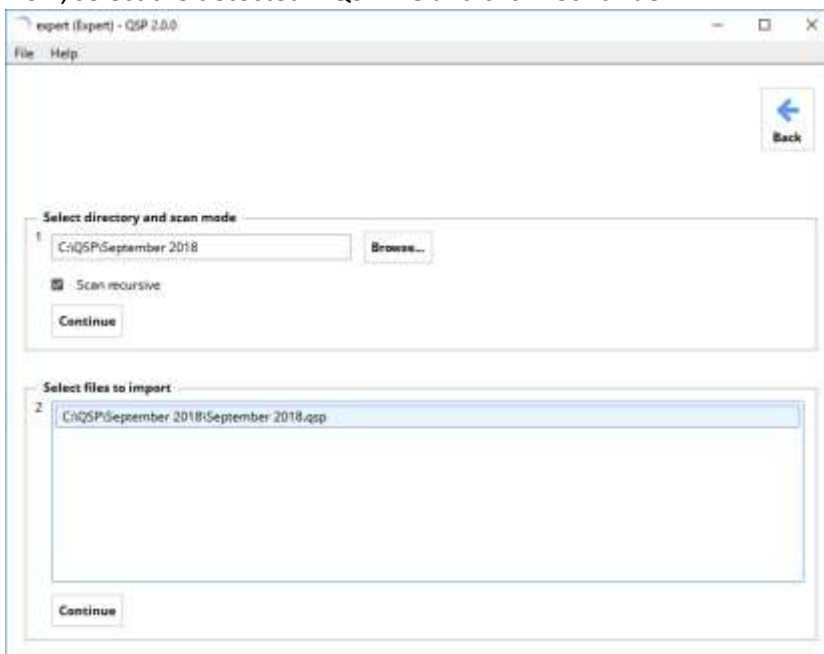
- 1) Click the “Add Slides” button.



- 2) Click the “Browse” button and select the folder where the Slide Package is stored. Check the “Scan recursive” option. Then click “Continue”.

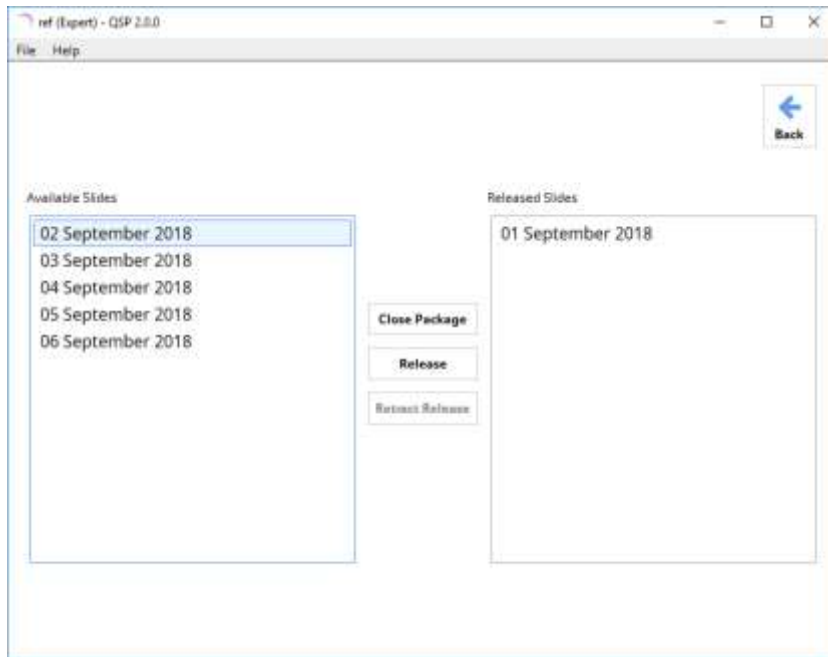


- 3) Now, select the detected *.QSP file and click “Continue”.



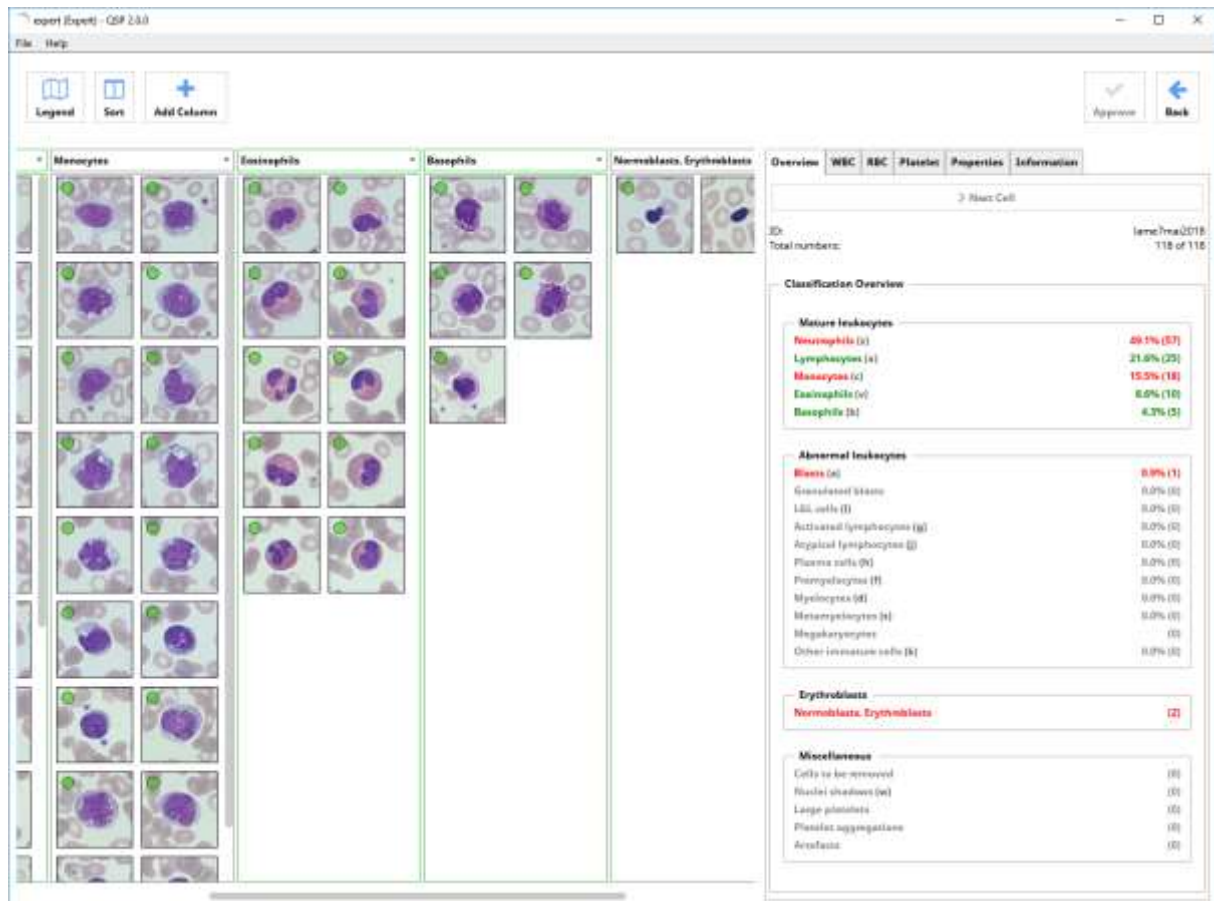
3.3.3. Release Virtual Slides within a Slide Package one by one

The left half lists all the virtual slides contained within the *Slide Package*. For each virtual slide, select the slide and click the “Release” button. Previously released slides are displayed in the right list. All released slides are then visible to *Assistant* users.



3.3.4. Sign-off on / Double-check provided Diagnosis

The left side displays all the cells in the virtual slide, grouped into columns by their cell class. The right side contains, grouped into six tabs, further slide-level information.



The *Virtual Slide* is released by clicking the “Approve” button in the top right corner. As a precautionary measure, the button remains greyed out until all cells have been examined. This ensures that the local resident expert agrees 100% with the diagnosis provided by Horiba Medical.

Each cell that has been visible for at least two seconds, will be marked with a green dot in its top left corner. Once all cells within a cell class column have been examined, the column’s border becomes green. Similarly, in the *Overview* tab’s *Classification Overview*, examined classes are highlighted green, remaining classes in red and empty classes in grey.

Corrections can be applied, simply by dragging a falsely classified cell into another column or onto the correct class name in the *Classification Overview* list.

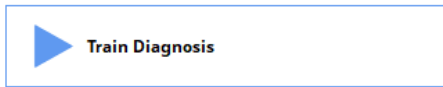
The local expert should check the following properties

1. Classification of each individual cell
2. Leukocyte Morphology (0|+|++|+++) in the “WBC” (white blood cell) tab
3. Erythrocyte Morphology (0|+|++|+++) in the “RBC” (red blood cell) tab
4. Platelet Morphology (0|+|++|+++) in the “Platelet” tab
5. The expert’s comment can be edited in the “Properties” tab

4. Diagnosing a Virtual Slide [Assistant]

After an Expert user has imported a new *Slide Package* and released some or all of the contained *Virtual Slides*, they are available for training to the *Assistant* users.

An Assistant user enters a new training run by clicking the “Train Diagnosis” button:



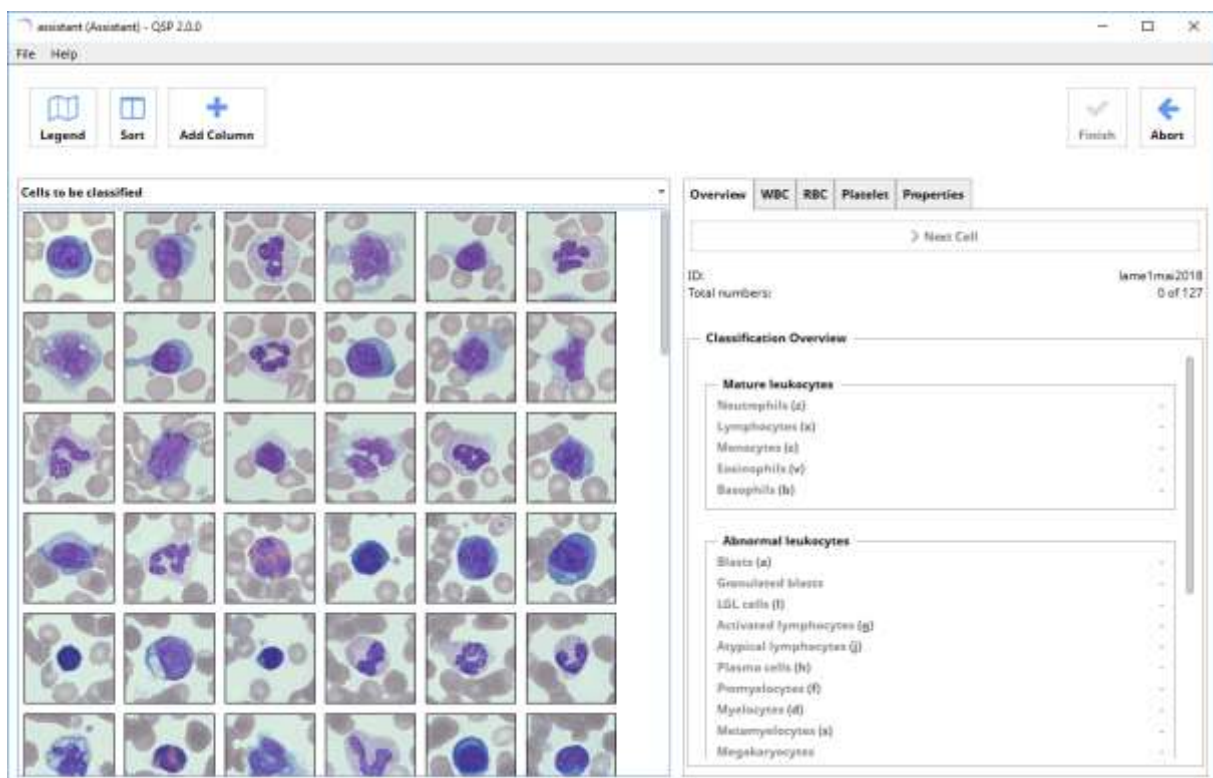
Next, select a Slide Package and then a single Virtual Slide within the package.



If no Slide Package is listed, a likely reason is that the Expert or Admin users have not yet imported and released a Slide Package.

The following user interface shows a single undiagnosed *Virtual Slide*. It is the user’s task to create a complete diagnose:

1. Assign each single cell to a class
2. Score the Leukocyte Morphology (0|+|++|+++) in the “WBC” (white blood cell) tab
3. Score the Erythrocyte Morphology (0|+|++|+++) in the “RBC” (red blood cell) tab
4. Score the Platelet Morphology (0|+|++|+++) in the “Platelet” tab



Overview with Cell Classes

WBC – White Blood Cell Morphology

Platelet Morphology

RBC – Red Blood Cell Morphology

Properties

The „Overview“ tab lists all possible cell classes. The character right next to the cell class is the keyboard shortcut, e.g. press “x” to re-assign all currently selected cells to the “Lymphocyte” class.

The rightmost figure gives the absolute number of cells that is currently assigned this class.

The tabs “WBC”, “RBC” and “platelets” each list a multitude of cell classes and cell properties that each need to be scored with one of the four classes “0”, “+”, “++” or “+++”.

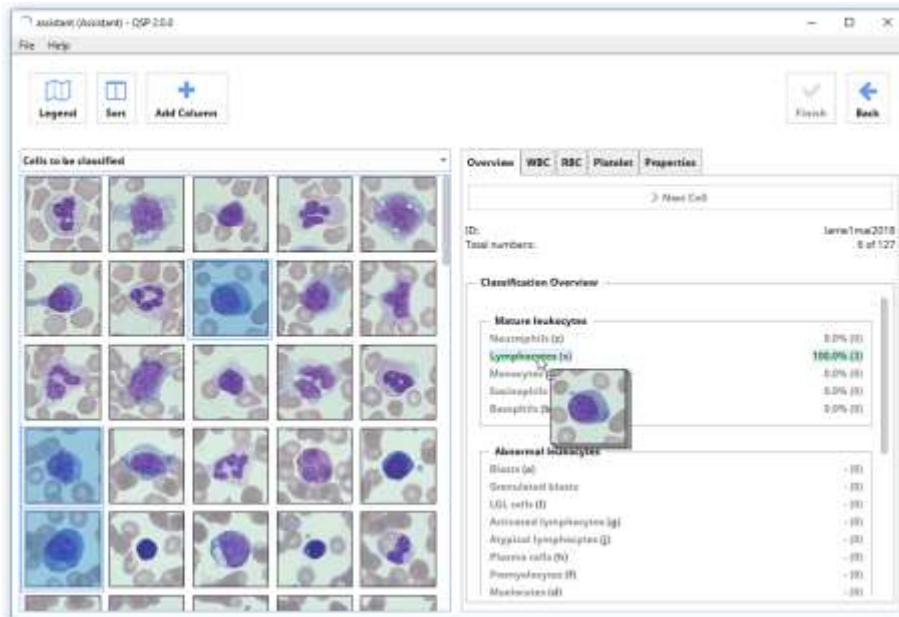
4.1. Patient Information

Relevant background information on the patient is available in the “Properties” tab.

4.2. Classify Cells

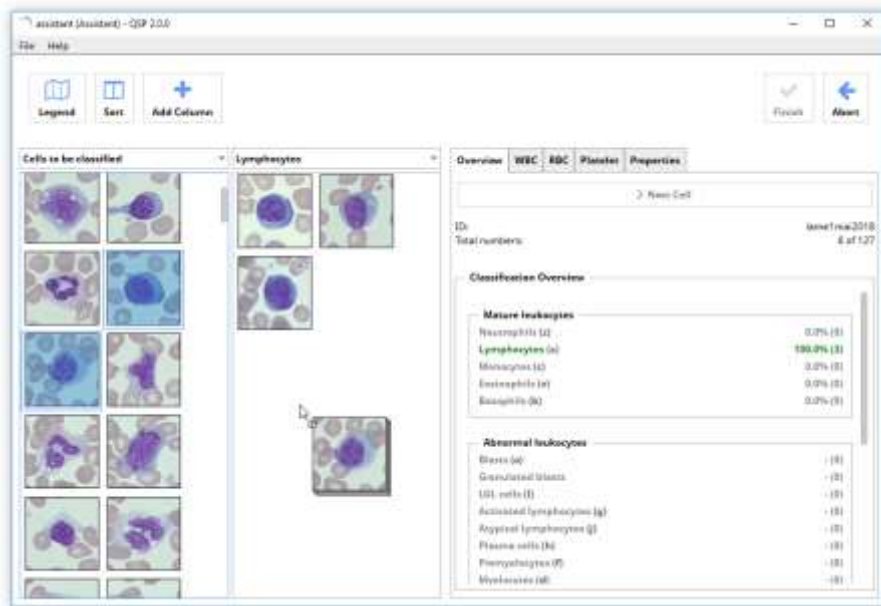
The user interface offers multiple options to classify cells.

- 1) Select one or more cells and drag & drop them onto a class in the “Overview” tab

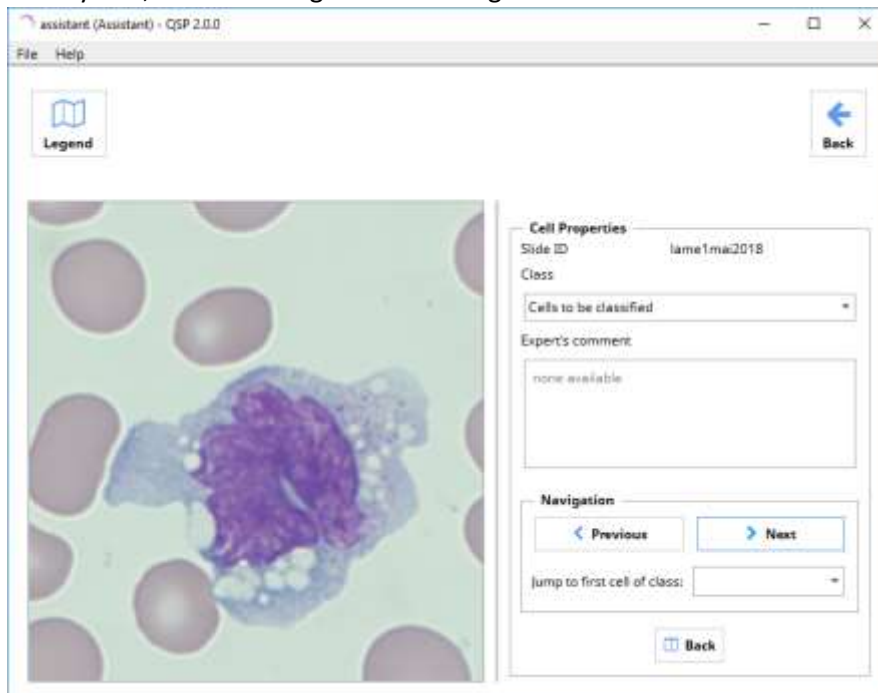


Select multiple cells by pressing the CTRL or SHIFT key.

- 2) Add a new column by clicking the “Add Column” button, select the desired class in the drop down box above the new column and finally drag&drop cells from any column into the new column.



- 3) Highlight one or more cells and press the class's keyboard shortcut indicated in round brackets right next to the class name, e.g. "x" for "Lymphocytes"
- 4) Enter the Single-Cell-View by double-clicking on a cell. Here, the class for the displayed cell can be selected in the "Class" drop-down-box on the top-right. One by one, iterate through all cells using the "Previous" or "Next" buttons.



4.3. Morphology

The "WBC" (white blood cells), "RBC" (red blood cells) and "platelet" tabs each list a multitude of cell classes and cell properties that each need to be scored with one of the four categories "0", "+", "++" or "+++". The left-hand side shows in the WBC-tab the white blood cell single images and in the RBC and platelet tabs a Virtual Slide with red blood cells.

Quantity	Cell Anomalies	Score
< 3 %	almost none	0
3-10%	Subtle, discrete, few	+
10-20%	noticeable, many	++
20-50%	Very distinct, a lot	+++

The red crosshair helps in judging the cells' sizes:



Crosshair	Size
outer diameter	14.0 microns
Inner diameter	7 microns

The *Virtual Slide* can be zoomed in and out using either the “Zoom In” and “Zoom Out” Buttons in the toolbar or by using the mouse wheel.

“Fit to Window” scales the *Virtual Slide* so that the entire slide is visible and all available window space is used.

“One to One” scales the *Virtual Slide* to the native resolution where one image pixel equals one window pixel.

assistant (Assistant) - QSP 2.0.0

File Help

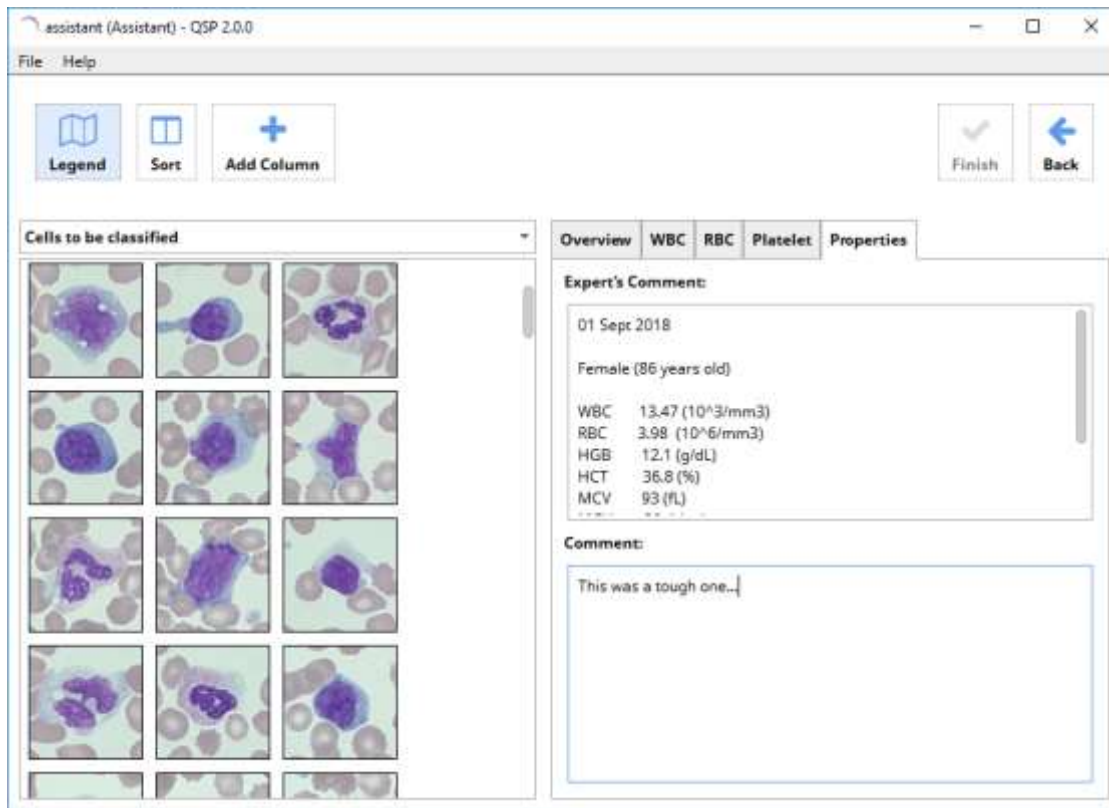
Zoom In Zoom Out Fit To Window One To One Legend Finish Back

For reference: red crosshair has outer (inner) diameter of 7 (3.5) microns

Overview	WBC	RBC	Platelet	Properties
Erythrocyte morphology				
<input type="checkbox"/>	+	++	+++	Microcytes 0 (0.00%)
<input type="checkbox"/>	+	++	+++	Macrocytes/Megalocytes 0 (0.00%)
<input type="checkbox"/>	+	++	+++	Anisocytosis 0 (0.00%)
<input type="checkbox"/>	o	+	++	Poikilocytosis 0 (0.00%)
<input type="checkbox"/>	o	+	++	Elliptocytes 0 (0.00%)
<input type="checkbox"/>	o	+	++	Acanthocytes 0 (0.00%)
<input type="checkbox"/>	o	+	++	Schistocytes 0 (0.00%)
<input type="checkbox"/>	o	+	++	Sickle cells 0 (0.00%)
<input type="checkbox"/>	o	+	++	Dacryocytes (tear drop cells) 0 (0.00%)
<input type="checkbox"/>	o	+	++	Echinocytes 0 (0.00%)
<input type="checkbox"/>	o	+	++	Target cells/Folded cells 0 (0.00%)
<input type="checkbox"/>	o	+	++	Stomatocytes 0 (0.00%)
<input type="checkbox"/>	o	+	++	Hypochromasia 0 (0.00%)
<input type="checkbox"/>	o	+	++	Hyperchromasia 0 (0.00%)
<input type="checkbox"/>	o	+	++	Spherocytes 0 (0.00%)
<input type="checkbox"/>	o	+	++	Polychromasia 0 (0.00%)
<input type="checkbox"/>	o	+	++	Basophilic stippling 0 (0.00%)

4.4. Properties and Comment

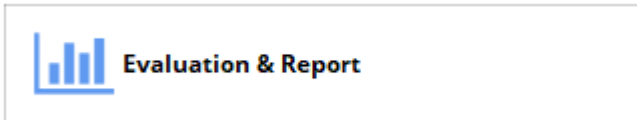
The tab “Properties” shows the expert’s comments on this case. The text is read-only. Additionally, the user may enter own comments. They will be included in the evaluation report.



5. Evaluation & Report

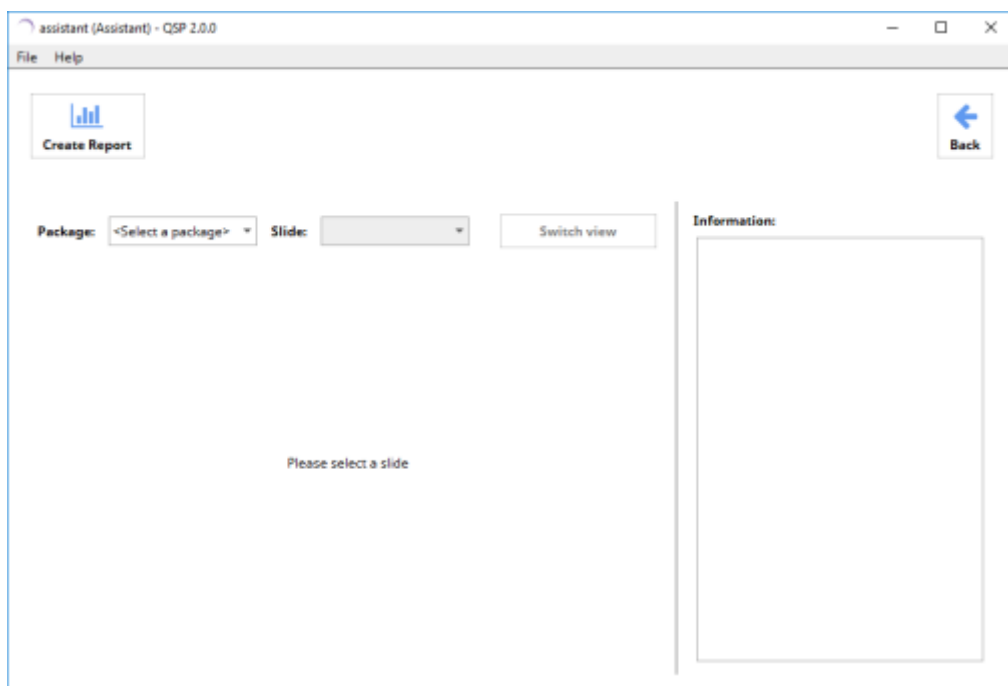
Click the “Evaluation & Report” button in the main menu to compare results from any previously diagnosis training with the ground truth provided by the expert.

Additionally, a PDF report of the comparison can be created as well as a table in CSV-Format, that can be opened e.g. with Microsoft Excel.



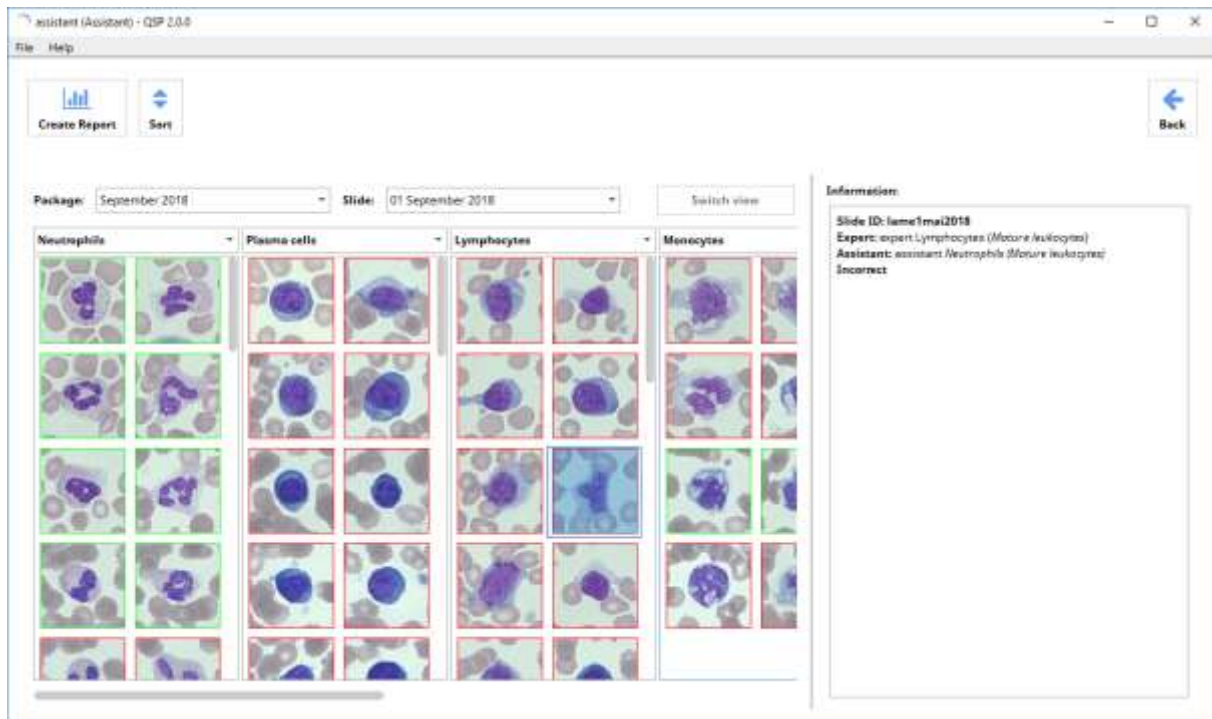
5.1. Evaluation

In the next view, first select a package and then select a single Slide from that package.



If no packages or no slides are available in the drop-down list, the likely reason is that no slides have been diagnosed yet.

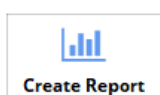
After a slide has been selected, all cells are marked with a green border, if they have been classified correctly, or with a red border otherwise.



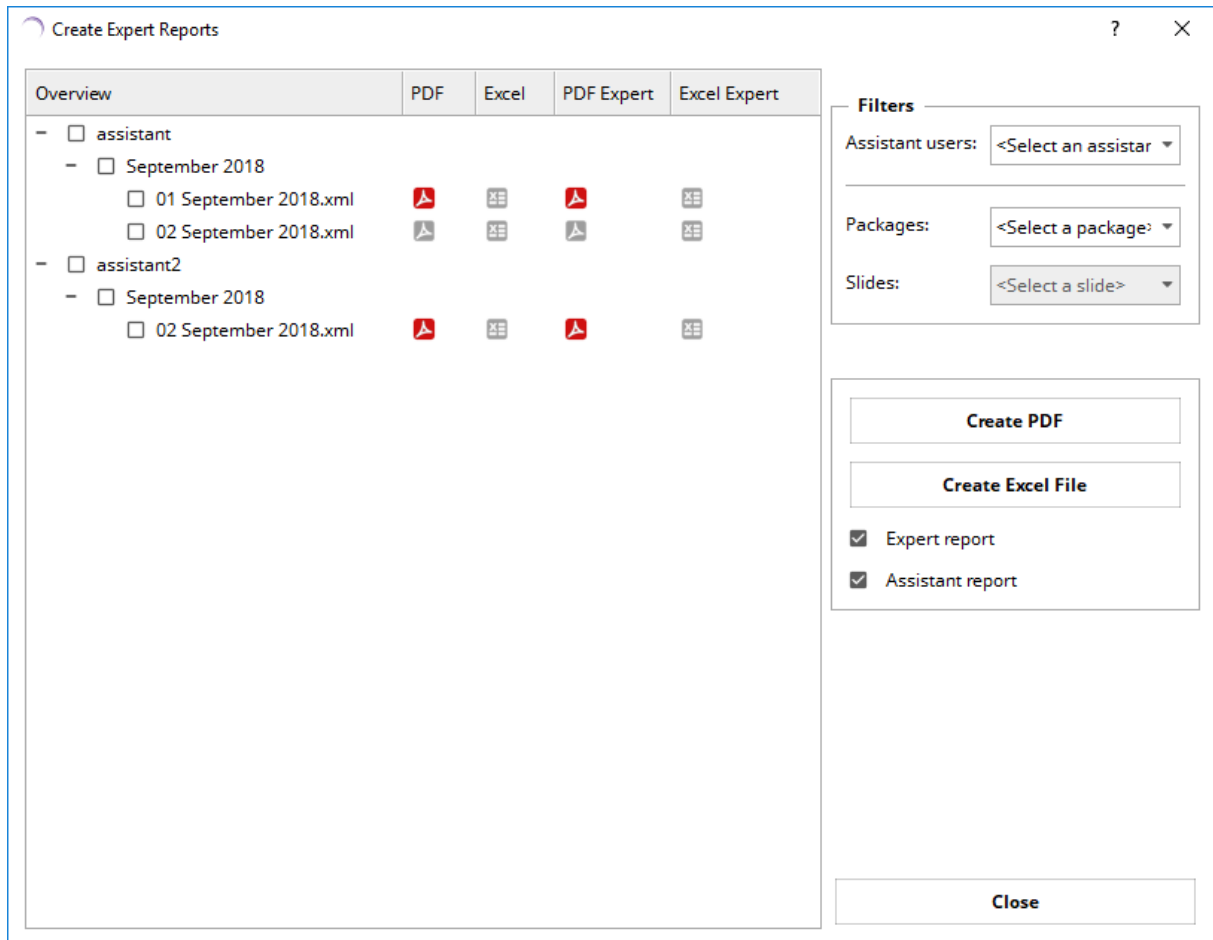
By clicking on a cell, the correct classification is displayed in the right-hand information panel.

5.1. Creating Report

By clicking the “Create Report” button, the current evaluation can be saved as a PDF file or a CSV-file that can be opened e.g. with Microsoft Excel.



A dialog pops up that lists in a tree structure (1st level: user name; 2nd level: package; 3rd level: slide) all packages and slides that can be saved. Mark the checkbox of all slides that shall be saved. After using *QSP* for a while, many slides will be listed here. The “Filters” option on the right-hand side can be used to conveniently filter the visible slides.



The columns “PDF” and “Excel” indicate whether a particular report had previously already been saved in this format. If this is not the case or the exported report files have been moved afterwards, the buttons remain greyed out. Colored buttons can be clicked to open the respective file in the default PDF or CSV viewer.

The “PDF Expert” and “Excel Expert” columns are only available to *Expert* users, not to *Assistant* users.

Once one or more slides have been selected, the “Create PDF” or “Create Excel File” buttons can be clicked to create the report file in the respective formats.

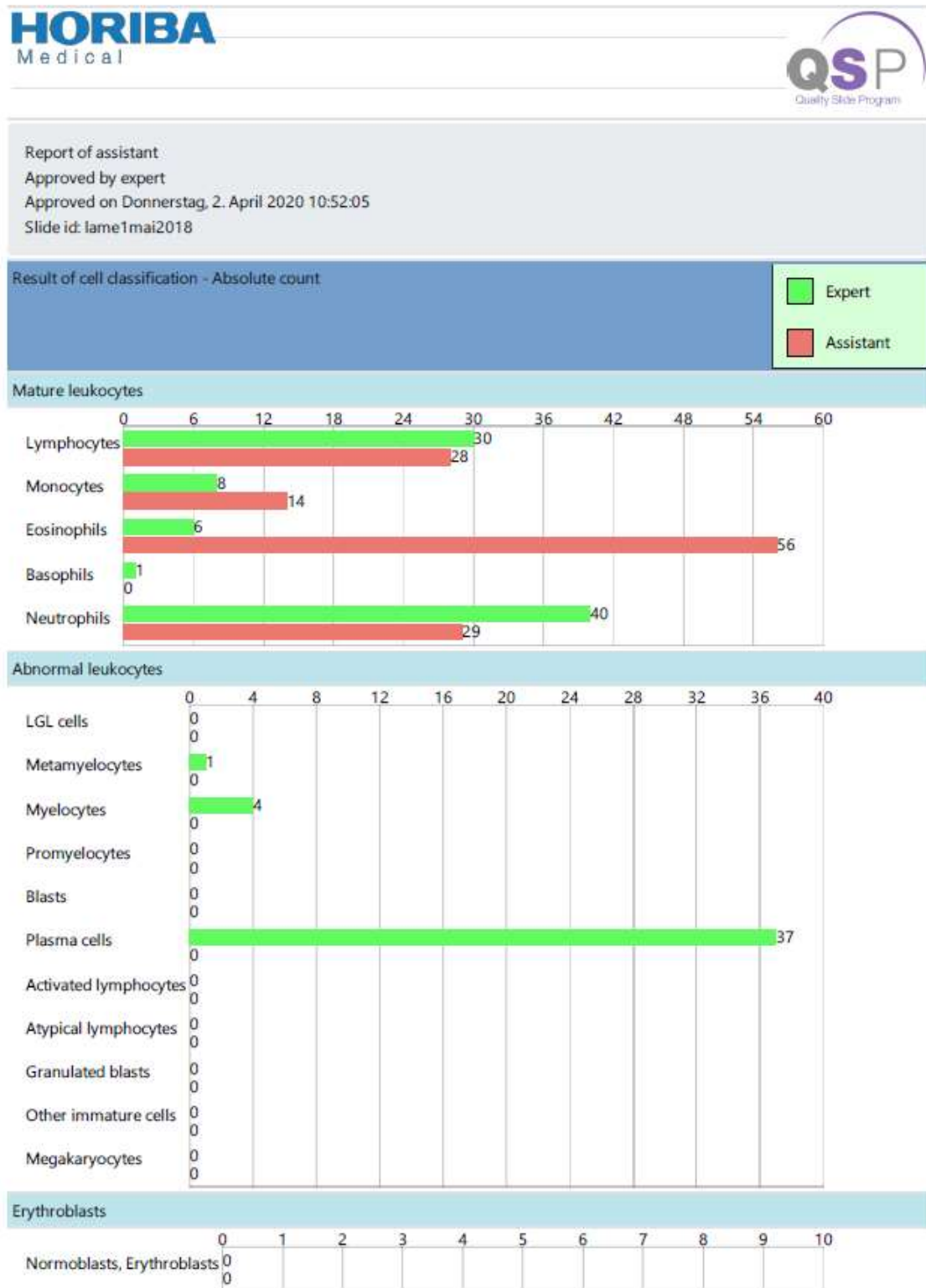
5.2. Reports

5.2.1. Assistant PDF Report

Every page in the report has a header that contains

- User name
- Date
- Slide name

The first section after the main header is the white blood cell classification result summary. It states for every cell class the quantity detected by the expert (green bar) and by the *Assistant* user (red bar).



Report of assistant
 Approved by expert
 Approved on Donnerstag, 2. April 2020 10:52:05
 Slide id: lame1mai2018

Result of cell classification - Absolute and relative frequencies

Name of cells	Assistant #	Assistant %	Expert #	Expert %
Mature leukocytes				
Lymphocytes	28	22.05	30	23.62
Monocytes	14	11.02	8	6.30
Eosinophils	56	44.09	6	4.72
Basophils	0	0.00	1	0.79
Neutrophils	29	22.83	40	31.50
Abnormal leukocytes				
LGL cells	0	0.00	0	0.00
Metamyelocytes	0	0.00	1	0.79
Myelocytes	0	0.00	4	3.15
Promyelocytes	0	0.00	0	0.00
Blasts	0	0.00	0	0.00
Plasma cells	0	0.00	37	29.13
Activated lymphocytes	0	0.00	0	0.00
Atypical lymphocytes	0	0.00	0	0.00
Granulated blasts	0	0.00	0	0.00
Other immature cells	0	0.00	0	0.00
Megakaryocytes	0	0.00	0	0.00
Erythroblasts				
Normoblasts, Erythroblasts	0	0.00	0	0.00
Miscellaneous				
Platelet aggregations	0	0.00	0	0.00
Large platelets	0	0.00	0	0.00
Nudei shadows	0	0.00	0	0.00
Artefacts	0	0.00	0	0.00

The second section lists the absolute and relative quantities of white blood cell classes detected by both the Assistant user and the expert.

Report of assistant
 Approved by expert
 Approved on Donnerstag, 2. April 2020 10:52:05
 Slide id: lame1mai2018

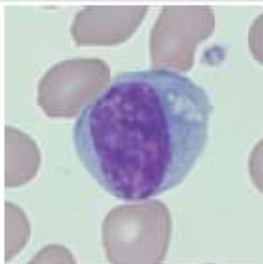
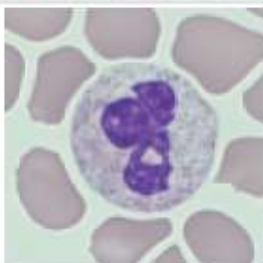
Result of cell classification - Sensitivity, Precision						
Name of cells	TP	FP	TN	FN	Sensitivity	Precision
Mature leukocytes						
Lymphocytes	6	22	75	24	0.2	0.21
Monocytes	2	12	107	6	0.25	0.14
Eosinophils	2	54	67	4	0.33	0.04
Basophils	0	0	126	1	0	-
Neutrophils	8	21	66	32	0.2	0.28
Abnormal leukocytes						
LGL cells	0	0	127	0	-	-
Metamyelocytes	0	0	126	1	0	-
Myelocytes	0	0	123	4	0	-
Promyelocytes	0	0	127	0	-	-
Blasts	0	0	127	0	-	-
Plasma cells	0	0	90	37	0	-
Activated lymphocytes	0	0	127	0	-	-
Atypical lymphocytes	0	0	127	0	-	-
Granulated blasts	0	0	127	0	-	-
Other immature cells	0	0	127	0	-	-
Megakaryocytes	0	0	127	0	-	-
Erythroblasts						
Normoblasts, Erythroblasts	0	0	127	0	-	-
Miscellaneous						
Platelet aggregations	0	0	127	0	-	-
Large platelets	0	0	127	0	-	-
Nudei shadows	0	0	127	0	-	-
Artefacts	0	0	127	0	-	-

The third section lists the sensitivity and precision of the white blood cell classification.

Term	Explanation
True Positive (TP) class A	Cell is class A and user classified A
False Positive (FP) class A	Cell is class other than A and user classified A
True Negative (TN) class A	Cell is class other than A and user classified other than A
False Negative (FN) class A	Cell is class A and user classified other than A
Sensitivity	$TP / (TP + FN)$
Precision	$TP / (TP + FP)$

Report of assistant
 Approved by expert
 Approved on Donnerstag, 2. April 2020 10:52:05
 Slide id: lame1mai2018

Result of cell classification - Misclassified cells

classified in Neutrophils	belongs to Plasma cells	
classified in Neutrophils	belongs to Lymphocytes	
classified in Neutrophils	belongs to Monocytes	
classified in Neutrophils	belongs to Lymphocytes	

The next section lists all misclassified white blood cells and states the false and correct class.

Report of assistant
 Approved by expert
 Approved on Donnerstag, 2. April 2020 10:52:05
 Slide id: lame1mai2018

Morphology

Experts observation	Assistants observation	Morphology
Erythrocyte morphology		
o	o	Microcytes
o	o	Macrocytes/Megalocytes
o	o	Anisocytosis
o	+	Poikilocytosis
o	o	Elliptocytes
o	++	Acanthocytes
o	o	Schistocytes
o	o	Sickle cells
o	o	Dacryocytes (tear drop cells)
o	+	Echinocytes
o	o	Target cells/Folded cells
o	++	Stomatocytes
o	o	Hypochromasia
o	o	Hyperchromasia
o	+++	Spherocytes
o	o	Polychromasia
o	o	Basophilic stippling
o	o	Howell-Jolly bodies
o	o	Cabotsch' rings
o	o	Pappenheimer bodies
o	o	Parasites
o	o	Rouleaux formation

This following sections list the true and observed morphology classification for the red blood cells, white blood cells and platelets.

Report of assistant
Approved by expert
Approved on Donnerstag, 2. April 2020 10:52:05
Slide id: lame1mai2018

Assistants comments and observations:

This was a tough one...

Experts comments and observations:

01 Sept 2018
Female (86 years old)
WBC 13.47 ($10^3/\text{mm}^3$)
RBC 3.98 ($10^6/\text{mm}^3$)
HGB 12.1 (g/dL)
HCT 36.8 (%)
MCV 93 (fL)
MCH 30.4 (pg)
MCHC 32.9 (g/dL)
PLT 136 ($10^3/\text{mm}^3$)
History of myeloma.

Corrective actions:



Assistants signature

Experts signature

The final section contains both the expert's and assistant's comments as well as fields to sign the report, if desired.

5.2.2. Assistant Excel Report

The CSV file is a comma separated text file that can be directly opened with Microsoft Excel. The export always creates two files:

-  assistant_September 2018_01 September 2018.csv
-  assistant_September 2018_01 September 2018_confusion.csv

The main file “<username>_<Slide Package name>_<Slide name>.csv” contains the white blood cell classification statistics per class:

	A	B	C	D	E	F	G
1	user_name	expert_name	test_date	approval_date	slideID	sw_version	cell_class
2	assistant	expert	Thu Apr 2 10:52:05 2020	Tue Apr 7 19:35:16 2020	lame1mai2018	QSP 2.0.0	Lymphocytes
3	assistant	expert	Thu Apr 2 10:52:05 2020	Tue Apr 7 19:35:16 2020	lame1mai2018	QSP 2.0.0	Monocytes
4	assistant	expert	Thu Apr 2 10:52:05 2020	Tue Apr 7 19:35:16 2020	lame1mai2018	QSP 2.0.0	Eosinophils
5	assistant	expert	Thu Apr 2 10:52:05 2020	Tue Apr 7 19:35:16 2020	lame1mai2018	QSP 2.0.0	Basophils
6	assistant	expert	Thu Apr 2 10:52:05 2020	Tue Apr 7 19:35:16 2020	lame1mai2018	QSP 2.0.0	LGL cells
7	assistant	expert	Thu Apr 2 10:52:05 2020	Tue Apr 7 19:35:16 2020	lame1mai2018	QSP 2.0.0	Neutrophils
8	assistant	expert	Thu Apr 2 10:52:05 2020	Tue Apr 7 19:35:16 2020	lame1mai2018	QSP 2.0.0	Metamyelocytes
9	assistant	expert	Thu Apr 2 10:52:05 2020	Tue Apr 7 19:35:16 2020	lame1mai2018	QSP 2.0.0	Myelocytes
10	assistant	expert	Thu Apr 2 10:52:05 2020	Tue Apr 7 19:35:16 2020	lame1mai2018	QSP 2.0.0	Promyelocytes
11	assistant	expert	Thu Apr 2 10:52:05 2020	Tue Apr 7 19:35:16 2020	lame1mai2018	QSP 2.0.0	Blasts
12	assistant	expert	Thu Apr 2 10:52:05 2020	Tue Apr 7 19:35:16 2020	lame1mai2018	QSP 2.0.0	Plasma cells
13	assistant	expert	Thu Apr 2 10:52:05 2020	Tue Apr 7 19:35:16 2020	lame1mai2018	QSP 2.0.0	Activated lymphocytes
14	assistant	expert	Thu Apr 2 10:52:05 2020	Tue Apr 7 19:35:16 2020	lame1mai2018	QSP 2.0.0	Atypical lymphocytes
15	assistant	expert	Thu Apr 2 10:52:05 2020	Tue Apr 7 19:35:16 2020	lame1mai2018	QSP 2.0.0	Granulated blasts
16	assistant	expert	Thu Apr 2 10:52:05 2020	Tue Apr 7 19:35:16 2020	lame1mai2018	QSP 2.0.0	Normoblasts, Erythroblasts
17	assistant	expert	Thu Apr 2 10:52:05 2020	Tue Apr 7 19:35:16 2020	lame1mai2018	QSP 2.0.0	Platelet aggregations
18	assistant	expert	Thu Apr 2 10:52:05 2020	Tue Apr 7 19:35:16 2020	lame1mai2018	QSP 2.0.0	Large platelets
19	assistant	expert	Thu Apr 2 10:52:05 2020	Tue Apr 7 19:35:16 2020	lame1mai2018	QSP 2.0.0	Nuclei shadows
20	assistant	expert	Thu Apr 2 10:52:05 2020	Tue Apr 7 19:35:16 2020	lame1mai2018	QSP 2.0.0	Other immature cells
21	assistant	expert	Thu Apr 2 10:52:05 2020	Tue Apr 7 19:35:16 2020	lame1mai2018	QSP 2.0.0	Artefacts
22	assistant	expert	Thu Apr 2 10:52:05 2020	Tue Apr 7 19:35:16 2020	lame1mai2018	QSP 2.0.0	Megakaryocytes

	H	I	J	K	L	M	N	O	P	Q	R
cell_group	cell_count	cell_count_g	true_cell_co	true_cell_pe	TP	FP	TN	FN	sensitivity	precision	
Mature leukocytes	28	0.220472	30	0.23622	6	22	75	24	0.2	0.21	
Mature leukocytes	14	0.110236	8	0.0629921	2	12	107	6	0.25	0.14	
Mature leukocytes	56	0.440945	6	0.0472441	2	54	67	4	0.33	0.04	
Mature leukocytes	0	0	1	0.00787402	0	0	126	1	0 -		
Abnormal leukocytes	0	0	0	0	0	0	127	0 -			
Mature leukocytes	29	0.228346	40	0.314961	8	21	66	32	0.2	0.28	
Abnormal leukocytes	0	0	1	0.00787402	0	0	126	1	0 -		
Abnormal leukocytes	0	0	-4	0.0314961	0	0	123	4	0 -		
Abnormal leukocytes	0	0	0	0	0	0	127	0 -			
Abnormal leukocytes	0	0	0	0	0	0	127	0 -			
Abnormal leukocytes	0	0	37	0.291339	0	0	90	37	0 -		
Abnormal leukocytes	0	0	0	0	0	0	127	0 -			
Abnormal leukocytes	0	0	0	0	0	0	127	0 -			
Abnormal leukocytes	0	0	0	0	0	0	127	0 -			
Erythroblasts	0	0	0	0	0	0	127	0 -			
Miscellaneous	0	0	0	0	0	0	127	0 -			
Miscellaneous	0	0	0	0	0	0	127	0 -			
Miscellaneous	0	0	0	0	0	0	127	0 -			
Abnormal leukocytes	0	0	0	0	0	0	127	0 -			
Miscellaneous	0	0	0	0	0	0	127	0 -			
Abnormal leukocytes	0	0	0	0	0	0	127	0 -			

The additional file “<username>_<Slide Package name>_<Slide name>_confusion.csv” contains a confusion matrix:

	A	B	C	D	E	F	
1	user	expert	testdate	approvalDate	slideID	softwareversion	
2	assistant	expert	Tue Apr 7 19	Thu Apr 2 10	lame1mai20	QSP 2.0.0	
3							
4	ConfusionMatrix						
5	x_axis = your prediction	y_axis = reference					
6							
7		Neutrophils	Lymphocytes	Monocytes	Eosinophils	Basophils	Blast
8	Neutrophils	8	7	2	23		
9	Lymphocytes	12	6	2	10		
10	Monocytes	4	1	2	1		
11	Eosinophils	1	2	1	2		
12	Basophils				1		
13	Blasts						
14	Granulated blasts						
15	LGL cells						
16	Activated lymphocytes						
17	Atypical lymphocytes						
18	Plasma cells	4	11	6	16		
19	Promyelocytes						
20	Myelocytes		1	1	2		
21	Metamyelocytes				1		
22	Megakaryocytes						

The white blood cell classes are listed both on the x and y axis. The y-axis contains the classes selected by the user. The x-axis contains the true classes.

In this example above 12 (B9) cells are really Neutrophils, but the user thought them to be lymphocytes. 8 neutrophils (B8) were correctly identified.

Ideally, the majority of cells are distributed on the diagonal axis, highlighted in the above screenshot.

5.2.3. Expert PDF Report

The expert is allowed to create both individual assistant reports as well as a per-slide expert report that contains joint statistics on all assistants who diagnosed the selected slide.

By default, both kinds (assistant report and expert report) are selected:

Create PDF

Create Excel File

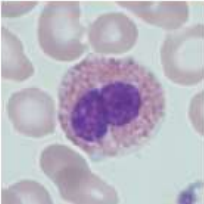
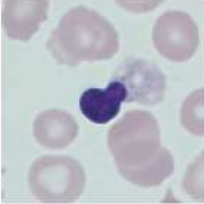

Expert report

Assistant report

The expert pdf report contains a peer comparison of the selected assistants. The first section lists for each white blood cell class and category each assistant's (average) sensitivity.

Peer Comparison		
User Name	Classes	Mean Sensitivity
assistant	Neutrophils	1
assistant2	Lymphocytes	0.48
assistant2	Basophils	0.4
assistant2	Mature leukocytes, Abnormal leukocytes	0.185
assistant	Mature leukocytes, Abnormal leukocytes	0.166667
assistant2	Neutrophils	0.12
assistant2	Monocytes	0.11
assistant2	Promyelocytes	0
assistant2	Myelocytes	0
assistant2	Eosinophils	0
assistant2	Metamyelocytes	0
assistant2	LGL cells	0

The next section lists for each misclassified cell the assistant's incorrect answers.

Misclassified cells			
Cell ID	False Classes (# users)	True Class	Cell
0	Basophils (1), Neutrophils (1)	Eosinophils	
1	Basophils (1), Neutrophils (1)	Normoblasts, Erythroblasts	
2	Monocytes (1)	Neutrophils	

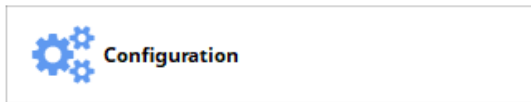
5.2.4. Expert Excel Report

The export CSV report has an identical structure to that of the assistant report. The only difference is that all selected assistants are collected within a single file (see column A). An extra file with a confusion matrix is not created.

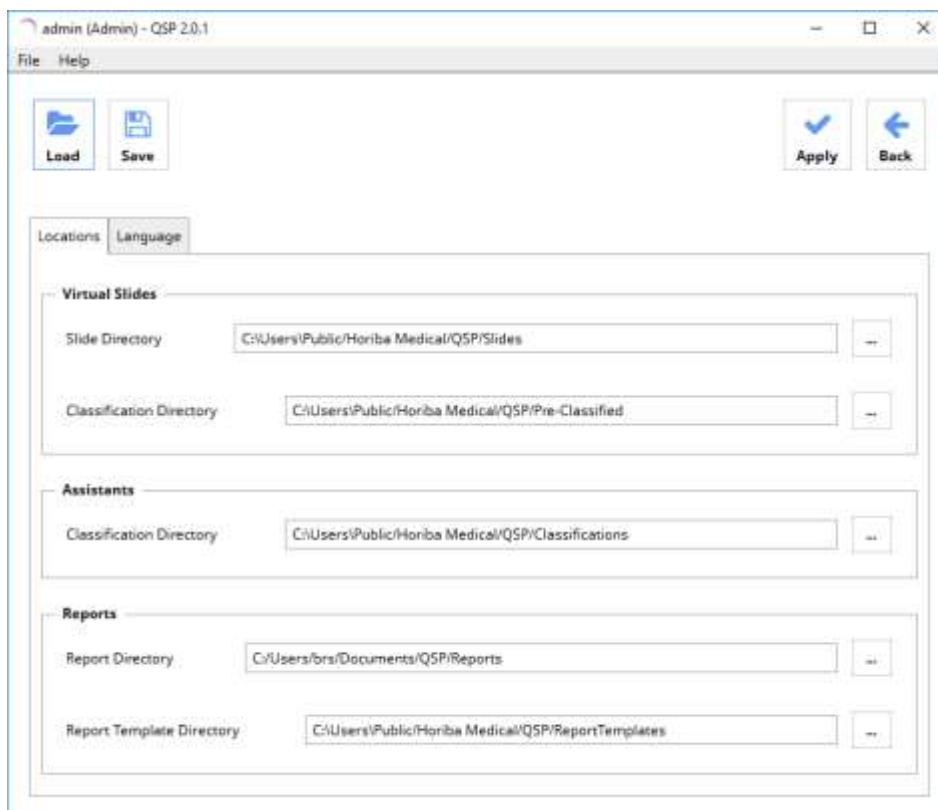
T	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	user_name	expert_name	test_date	approval_date	slideID	sw_version	cell_class	cell_group	cell_count	cell_count_true	cell_count_false	TP	FP	TN	FN	F1	sensitivity	precision
16	assistant	expert	Fri Apr 10 13:49:58 2020	Fri Apr 10 14:38:21 2020	lame7mat20	QSP 2.0.0	Normoblast	Erythroblast	0	0	2	0.0172414	0	0	118	2	0	-
17	assistant	expert	Fri Apr 10 13:49:58 2020	Fri Apr 10 14:38:21 2020	lame7mat20	QSP 2.0.0	Platelet aggr	Miscellaneous	0	0	0	0	0	0	118	0	-	-
18	assistant	expert	Fri Apr 10 13:49:58 2020	Fri Apr 10 14:38:21 2020	lame7mat20	QSP 2.0.0	Large platelet	Miscellaneous	0	0	0	0	0	0	118	0	-	-
19	assistant	expert	Fri Apr 10 13:49:58 2020	Fri Apr 10 14:38:21 2020	lame7mat20	QSP 2.0.0	Nuclei shed	Miscellaneous	0	0	0	0	0	0	118	0	-	-
20	assistant	expert	Fri Apr 10 13:49:58 2020	Fri Apr 10 14:38:21 2020	lame7mat20	QSP 2.0.0	Other immat	Abnormal le	0	0	0	0	0	0	118	0	-	-
21	assistant	expert	Fri Apr 10 13:49:58 2020	Fri Apr 10 14:38:21 2020	lame7mat20	QSP 2.0.0	Artefacts	Miscellaneous	0	0	0	0	0	0	118	0	-	-
22	assistant	expert	Fri Apr 10 13:49:58 2020	Fri Apr 10 14:38:21 2020	lame7mat20	QSP 2.0.0	Megakaryoc	Abnormal le	0	0	0	0	0	0	118	0	-	-
23	assistant2	expert	Fri Apr 10 13:49:58 2020	Fri Apr 10 14:11:53 2020	lame7mat20	QSP 2.0.0	Lymphocyte	Mature leuk	38	0.322	25	0.215517	12	26	67	13	0.46	0.32
24	assistant2	expert	Fri Apr 10 13:49:58 2020	Fri Apr 10 14:11:53 2020	lame7mat20	QSP 2.0.0	Mimocytes	Mature leuk	9	0.076	18	0.155172	2	7	95	26	0.11	0.22
25	assistant2	expert	Fri Apr 10 13:49:58 2020	Fri Apr 10 14:11:53 2020	lame7mat20	QSP 2.0.0	Eosinophils	Mature leuk	11	0.093	10	0.0862069	0	11	97	10	0	0
26	assistant2	expert	Fri Apr 10 13:49:58 2020	Fri Apr 10 14:11:53 2020	lame7mat20	QSP 2.0.0	Basophils	Mature leuk	44	0.373	3	0.0431034	2	42	71	3	0.4	0.05
27	assistant2	expert	Fri Apr 10 13:49:58 2020	Fri Apr 10 14:11:53 2020	lame7mat20	QSP 2.0.0	COL cells	Abnormal le	0	0	0	0	0	0	118	0	-	-
28	assistant2	expert	Fri Apr 10 13:49:58 2020	Fri Apr 10 14:11:53 2020	lame7mat20	QSP 2.0.0	Neutrophils	Mature leuk	18	0.136	37	0.491379	7	9	52	30	0.32	0.44
29	assistant2	expert	Fri Apr 10 13:49:58 2020	Fri Apr 10 14:11:53 2020	lame7mat20	QSP 2.0.0	Melanveloc	Abnormal le	0	0	0	0	0	0	118	0	-	-

Configuration [Admin only]

Only the Admin user can enter and change the configuration:



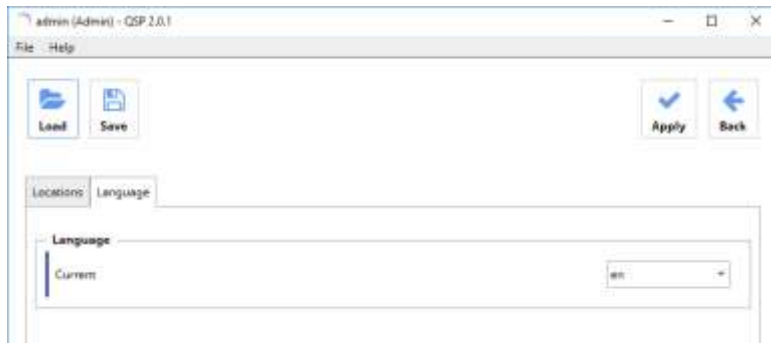
5.3. Storage Locations



In the “Locations” tab, the locations where data will be stored is specified.

Data Kind	Description
Slide Directory	Pre-diagnosed slide packages with image data provided by Horiba.
Classification Directory	Folder where the ground truth diagnosis entered by Expert users is stored as XML files in one subfolder folder per user and per slide.
Assistants Classification Directory	Location where assistant user’s training diagnosis is stored in one subfolder per user. Additionally, the paths of previously saved reports is also stored here
Report Directory	Default folder where reports are stored. The user can override this when saving a report.
Report Template Directory	Location where report templates are stored. These templates can be customized, but only technically proficient users should attempt to do this.

The “Language” Tab contains an option to change the language of *QSP*.



To change the language, select the new language from the drop-down menu and then restart *QSP*.

6. Third Party Software

This software utilizes various open source software libraries. Their licenses can be found in the “ThirdPartyLicenses” folder in the install directory.

This software is based in part on the work of the Independent JPEG Group.

7. Contact Information

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