Augmentiqs


DEVELOPER INFORMATION KIT

DEPLOYING 3RD PARTY ALGORITHMS IN AUGMENTIQS

AUGMENTIQS – PRODUCT OVERVIEW

Augmentiqs is an electro-optical module that integrates within existing infinity-corrected optical microscopes of any manufacturer or model. It is a combined hardware and software solution that enables multi-directional communication between microscope and PC.

The hardware component installed on the existing microscope acts as a platform for digital imaging, digital overlay (augmented reality) and tracking of microscope stage activity.
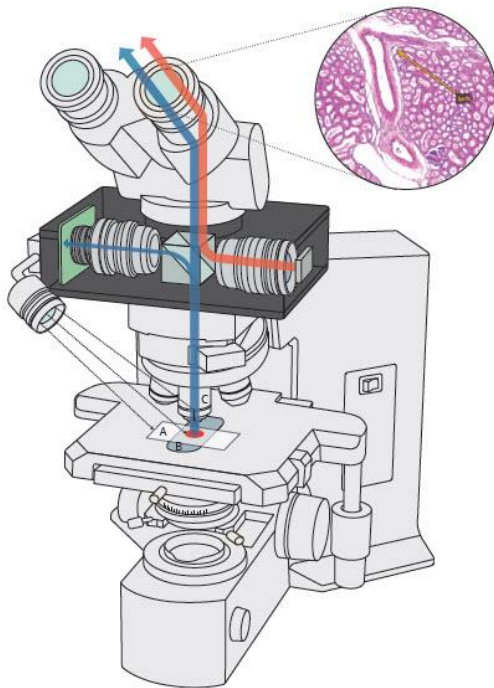
The high-resolution image capturing system obtains a Field of View (FOV) output that is close to a 1:1 view of the eyepiece (depending on the microscope and objective used). The use of a considerably efficient digital imaging sensor allows for the integration of highly sensitive software applications to be used for the enhancement of clinical efficiency.

The digital overlay allows the microscope user to continue viewing the same optical plane of the tissue, while utilizing augmented reality for simultaneous viewing of relevant digital information inside the microscope eyepiece.

The digital tracking is an auxiliary camera for tracking the XY slide position, slide label identification and objective magnification.

The Augmentiqs software, which is installed on the pathologist's adjacent computer, controls the functionality of the hardware components. The Augmentiqs software funnels the activity of the pathologist into a database on the pathologist's computer. It synchronizes the metadata of the slide on the microscope stage with the digital image of the FOV, providing a complete digital file of all activity performed on the microscope.

OPEN API

The Augmentiqs software has an Open API, affording multi-directional communication and integration with any digital system/software. This multi-directionality feature allows for the Augmentiqs system to be highly interoperable with other digital microscopy technologies within the microscope itself.
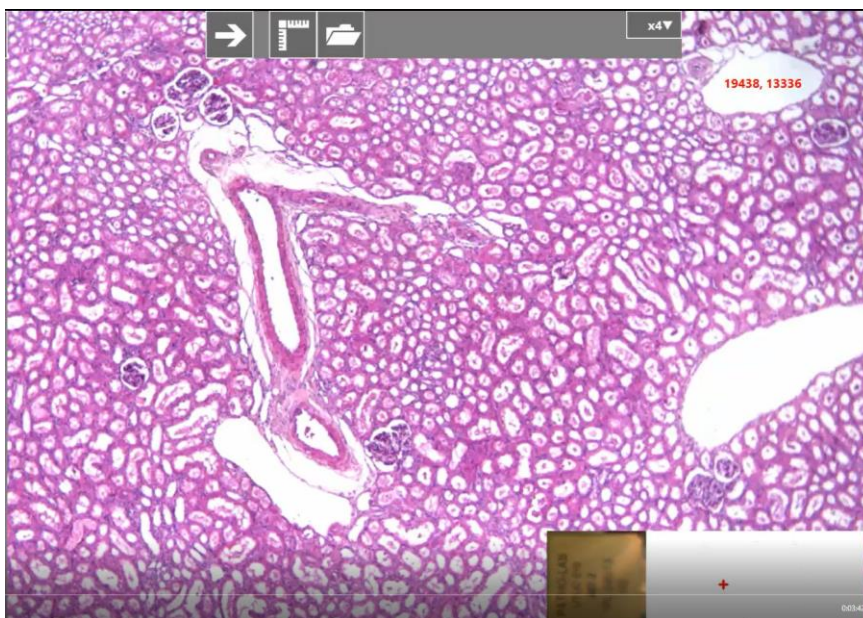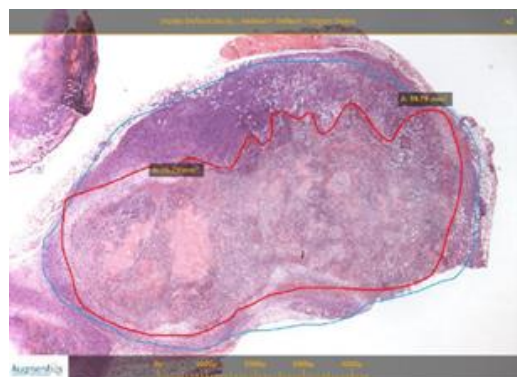
Algorithms Integration API
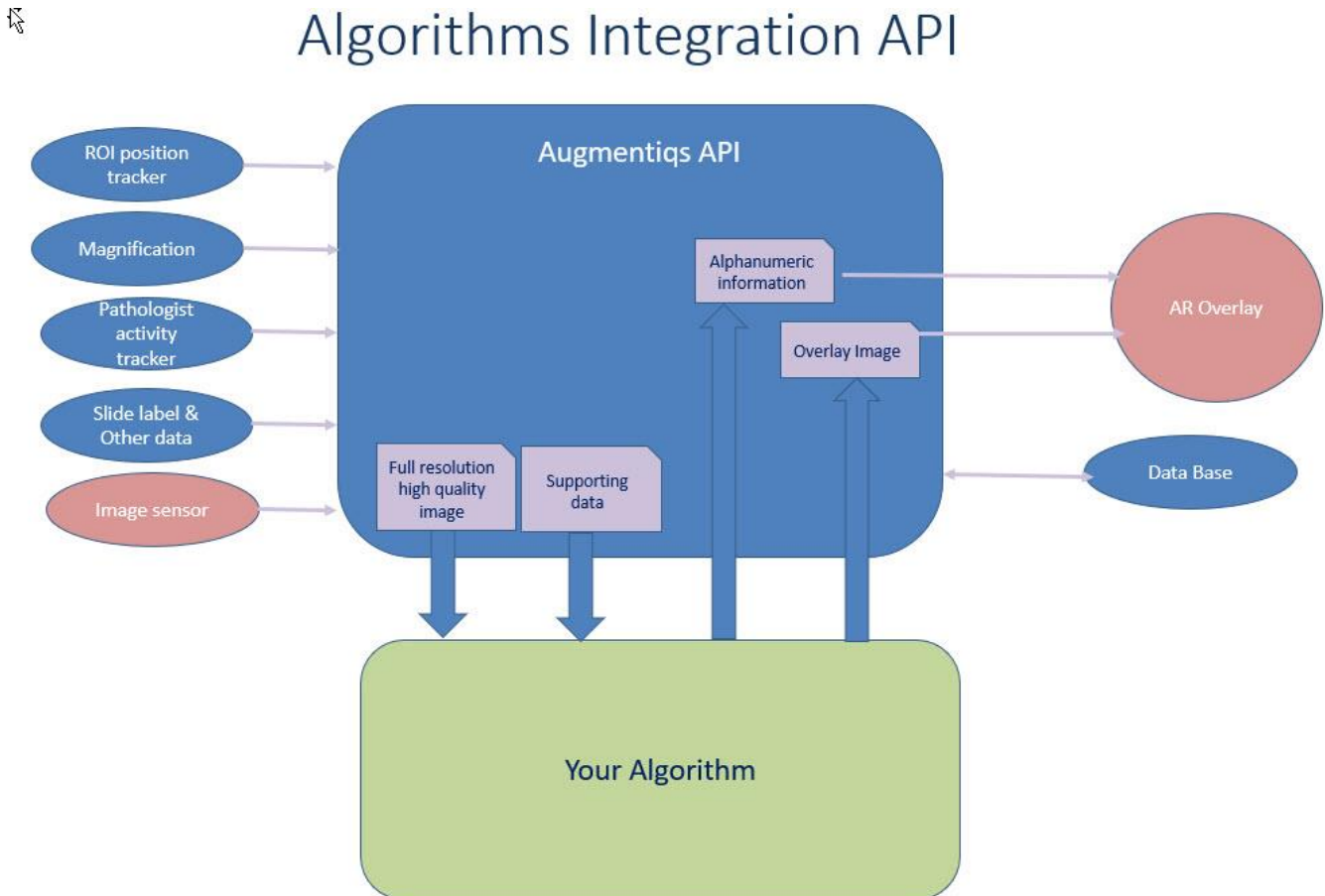
DATA OUTPUT

Augmentiqs is able to generate the following data output:

Data	Format
Histopathology Image	TIFF, PNG, BMP/20mp rolling shutter or 12 mp global shutter 1 inch sensor/up to 30 FPS – application dependent
XY slide position to within 40 micron accuracy	CSV, heatmap raster
Slide label image	JPG
Annotations & morphometrics	Vector format, or Raster
Objective magnification	JPG, automatic calibration with image
Metadata	File-based with separate indexing, optional SQL

- Histopathology image as TIFF or PNG
- XY slide position to within 40 micron,
- Slide label image
- Annotations and morphometric measurements
- Objective magnification
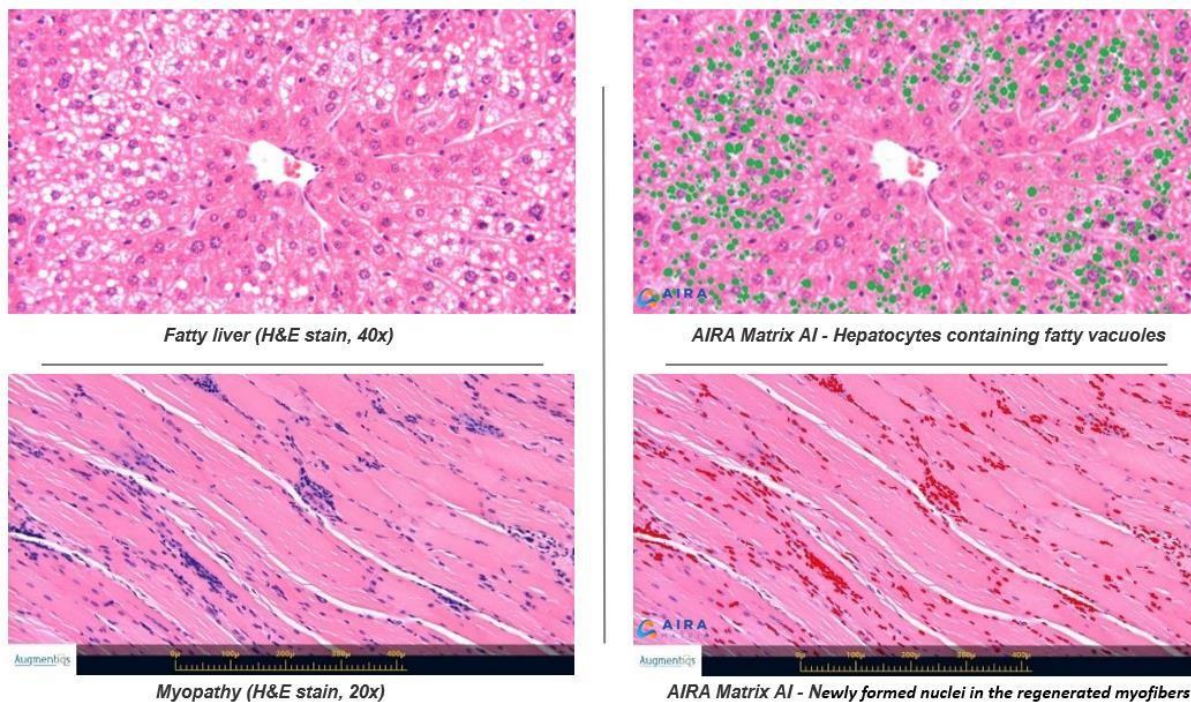- Image metadata: Time, date, pathologist ID, Case information

DATA INPUT

Augmentiqs is able to wrap existing 3rd party code within its platform, and deploy these algorithms within a single, combined workflow. In addition to quantitative algorithms, Augmentiqs can integrate with other software and hardware such as, but not limited to LIS to display case data or Whole Slide Imaging systems.

Augmentiqs has successfully deployed ImageJ, QuPath, and AIRA Matrix AI algorithms.

Fatty liver (H&E stain, 40x)

AIRA Matrix AI - Hepatocytes containing fatty vacuoles

Myopathy (H&E stain, 20x)

AIRA Matrix AI - Newly formed nuclei in the regenerated myofibers

Images taken with Augmentiqs by Dr. Abraham Nyska on behalf of Integrated Laboratory Systems Inc study. AI performed by AIRA Matrix.

Augmentiqs is based on Windows OS and built using Microsoft .NET framework. It maintains an open interface that is accessible via .NET / COM, WCF as well as Java Native Interface or direct C++ calls via P/Invoke.

Typically, Augmentiqs integrates third-party plugins using small .NET wrapper that uses the Augmentiqs API from one side, and connects to third-party API from the other side. This wrapper is custom-created after quick discussion on exchange format between Augmentiqs and 3rd party development teams. However, there are instances where unique code will be developed to support some advanced application workflow. Augmentiqs is willing to provide assistance and guidance when such necessity is recognized. Below is an example of integration code.

Example: A 3rd party has developed advanced segmentation functionality. It provides a simple C++ library which is statically linked to .NET wrapper library using P/Invoke. The interface could be something very simple like:

byte[] GetSegmentedImage(byte[] inputImage, string metadata);

where: inputImage -- PNG bitmap serialized to byte array

metadata -- json with number of parameters that we agree on

output: PNG bitmap serialized to byte array

The json encoding should contain several parameters, like user selection mouse coordinates (an array of points, in image coordinate system, origin is in top-left), ROI (if needed), selection line color (in web format aka: #AARRGGBB)

```
{

"Points": [

    "(96, 563)",

    "(29, 542)",

     ...

  ],

 "ROI": "[(9, 23); <466, 221>]",

  "Color": "#FF00A2E8",

}
```

> **"The ability to use JSON objects as metadata on the fly for communication is extremely powerful."**
>
> Digital Pathology Software Developer

Augmentiqs supports multiple formats, and multiple languages. Please contact Augmentiqs support for specific questions relating to your application. support@augmentiqs.com

ARTIFICIAL INTELLIGENCE

Augmentiqs can be used by groups developing Artificial Intelligence (AI) based algorithms. This can include both as a method for capturing data, and for utilizing an algorithm during routine workflow.

Collecting Data:

Augmentiqs enable automatic data collection during the native pathology workflow. Without any input from the pathologist, Augmentiqs is able to collect all relevant data, score according to perceived importance based upon preset parameters, and allow easy data collection via filtered search.

Once a database has been set up, users can look up or edit details using a built-in browser; additional notes, annotations, and measurements can be applied to saved images.

For example, images can be automatically saved in a database, with each image tagged by a timestamp, reason for image capture, objective magnification, slide label, XY tracking, annotations and more.

All saved data is open format.
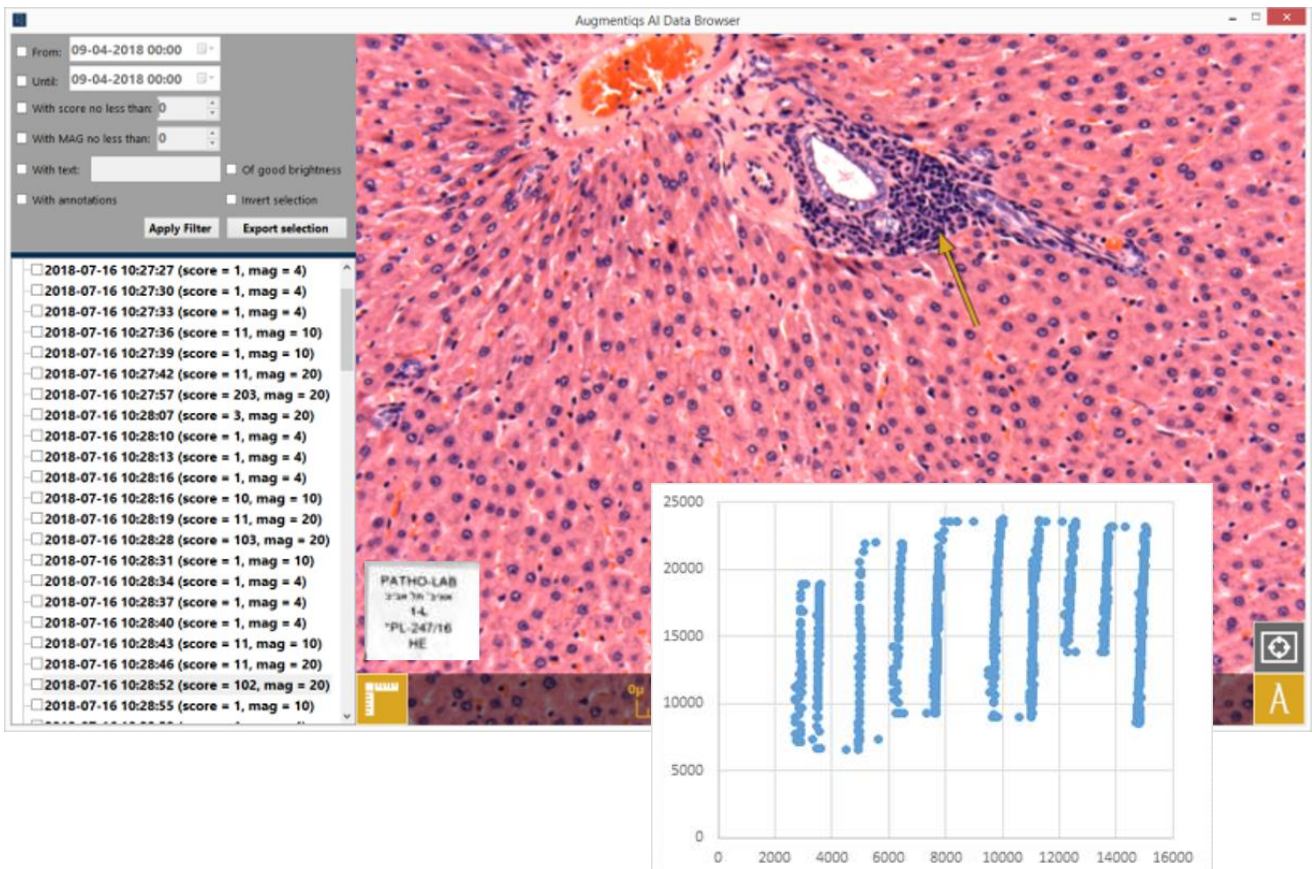
SYSTEM REQUIREMENTS

Augmentiqs is a Windows-operated, 64-bit system.

Augmentiqs is connected to the controlling PC via HDMI (x1) for visual information to the augmented reality projector, USB 3.0 (main optical camera), USB 2.0 (data transfer), and mini-USB 2.0 (stage tracking camera).

Below are the suggested minimum operating requirements. Artificial Intelligence applications will require more advanced hardware.

1.   CPU: i7-6770HQ or comparable (4 cores, 8 threads)

2.   RAM: 8 GB

3.   SSD: 10GB

4.   Display: Full HD (1920 x 1080 pixel-resolution) with IPS technology for proper color gamut support.

5.   Ports: HDMI (x1), USB 3.0 (x1), USB 2.0 (x2)

6.   Graphics card supporting dual-monitor display.

7.   Windows 7 or higher, 64-bit

8.   For telepathology - Internet upload speed of at least 2 Mbps. For telepathology sessions with more than 3 remote viewers, upload speed of at least 5 Mbps.

9.   Internet-facing firewall allowing outbound/inbound TCP ports 443 and 80 connections.