Lab 13. Using AI and RPA for Invoice Processing

In this lab, we will complete our first project with Automation Anywhere RPA and **Artificial Intelligence** (**AI**).

We will use the Automation Anywhere IQ Bot to convert invoice data from an unstructured format into a structured format that we can use for automation. IQ Bot is an intelligent document processing platform from Automation Anywhere that can be used to classify, extract, and validate content from documents. IQ Bot allows us to process unstructured data using AI technologies such as computer vision, **Natural Language Processing** (**NLP**), **Machine Learning** (**ML**), and text classification.

More than 80% to 90% of data in organizations is placed in documents and forms. So, processing documents is one of the common requirements for most automation use cases.

We will learn about basic document processing and more in this lab. More specifically, we will cover the following topics:

- Using basic AI with RPA
- Document processing using IQ Bot
- Creating learning instances for document processing
- Invoking IQ Bot with the A2019 Task Bot
- Downloading unstructured data from IQ Bot

Technical requirements

The following are the technical requirements you'll need for this lab:

- Automation Anywhere A2019 Community Edition. Sign up at https://www.automationanywhere.com/products/community-edition.
- A PC with the Automation Anywhere Community Edition A2019 Bot Agent installed.
- Google Chrome with the Automation Anywhere extension installed.
- Sample invoices to process. You can download this from the A2019 IQ Bot.
- Microsoft Excel 2007 or any program that can be used to view CSV files.

Intelligent document processing

When we started using RPA in our organization, one of the major difficulties we faced was the need to process a large volume of documents. Since these documents and forms contribute to a bulk of the data in the enterprise, this is the experience of many early RPA practitioners.

The traditional way to process documents with RPA was to use **Optical Character Recognition **(**OCR**). This technology has many limitations when it comes to different document formats, interpreting natural language, and detecting blurred and scanned text. Without intelligence, OCR is not accurate and impedes straight-through processing.

Now that we can use AI with RPA, we have the ability to perform **Intelligent Document Processing** (**IDP**), which uses ML to read, classify, and extract the data in these documents into structured data. The documents that usually need processing include emails, forms, PDF documents, and scanned documents. With IDP, we can use the generated structured data to automate more processes end to end.

We will be looking at this option of using AI for IDP and enabling straight-through processing for our automation. Also, RPA with AI -- Cognitive Automation - is one of the most promising areas in RPA. This is the reason we have

included this topic -- so that you can some experience in this evolving area.

Both UiPath and Automation Anywhere offer IDP solutions. Let's take a look at them.

UiPath -- Document Understanding

The Document Understanding offering from UiPath can be used to extract data from a wide range of document types.

The major phases of this solution are as follows:

- **Load Taxonomy**: This is the form and fields hierarchy and will be used for classification and extraction.
- **Digitize**: Uses different OCR engines to digitize the document into a machine-readable format.
- **Classify**: Classifies document types; for example, claims, invoices, and receipts.
- **Extract**: Extracts data from forms, such as name and date of birth.
- **Validate**: Validates and corrects the extracted data against the data in the document.
- **Export**: Exports the data as an output file; for example, Excel.

There are different OCR engines that are shipped with this package that can be used to digitize the documents in different formats, such as PDF, TIFF, JPEG, and so on. Classifying and extracting the content is done with position-based form extractors.

ML extraction is also available for specific formats such as invoices, receipts, and purchase orders. Custom machine models can be built for specific cases too. An interesting aspect of this solution is that it allows us to mix and match available form extractors and machine leaning extractors at the field level of the forms.

Automation Anywhere -- IQ Bot

The IQ Bot offering from Automation Anywhere uses machine learning to extract structured or semi-structured data from documents.

IQ Bot uses AI technologies such as machine learning, computer vision, and NLP to learn and extract information from business documents and emails.

The main features of IQ Bot are as follows:

- **Classification**: IQ Bot uses AI-based learning algorithms to recognize and classify content.
- **Digitization**: It does not rely on traditional OCR. Instead, it uses the latest computer vision technologies to intelligently digitize documents.
- **Continuous learning**: It learns from user feedback and validation, thereby improving its classification and extraction accuracy over time.

There are five key phases of the IQ Bot process:

- Create a learning instance
- Review and update field mapping
- Load documents to classify and extract data
- Output the extracted data
- Validate forms with issues

And if necessary, retrain the learning instance. We will be covering most of these phases in this lab.

Now, let's look at the project components and how we can perform intelligent document processing for invoices using the Automation Anywhere IQ Bot.

Project overview

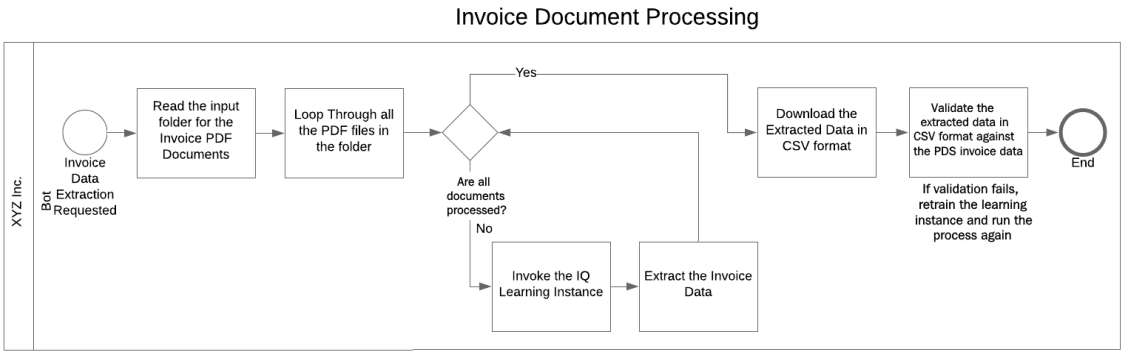
In this project, we will create a bot that will use RPA and AI to process invoices.

First, we will create an IQ Bot learning instance so that we can classify invoices and extract invoice details from PDFs and place them in a CSV file. The IQ Bot will learn our invoice format using AI and process them.

Then, we will use an A2019 Task Bot to feed the invoices that we'd like to process. We will loop through each file in the Invoice inputs folder and upload them to the IQ Bot Learning instance we'll create.

Once the Upload bot has run successfully, we will be able to download the CSV files from the IQ Bot. We will use another Task Bot to download the CSV files and verify the data contained within them. If there are any shortcomings, we can retrain the IQ Bot.

The overall workflow is as follows:

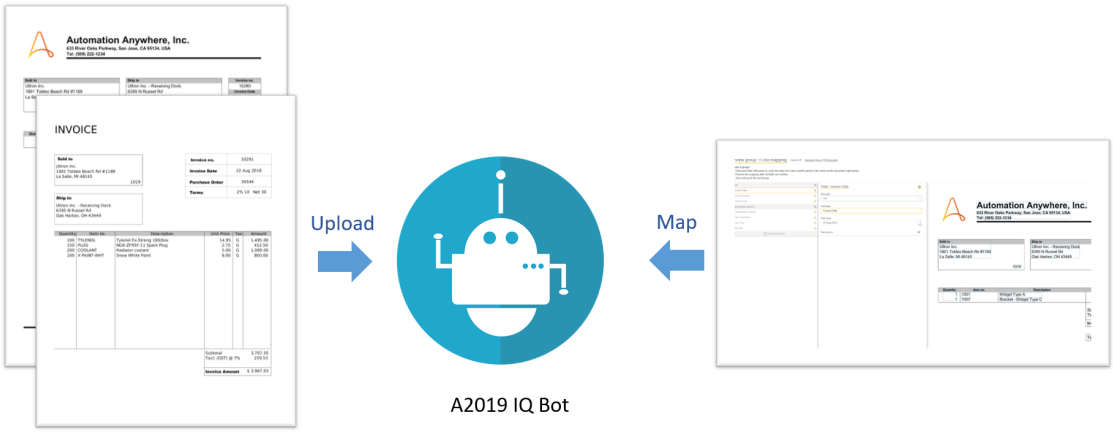


What we are doing here is intelligent document processing using AI. This is an important area where RPA is making a difference in enterprises. Now, let's take a look at the project's components.

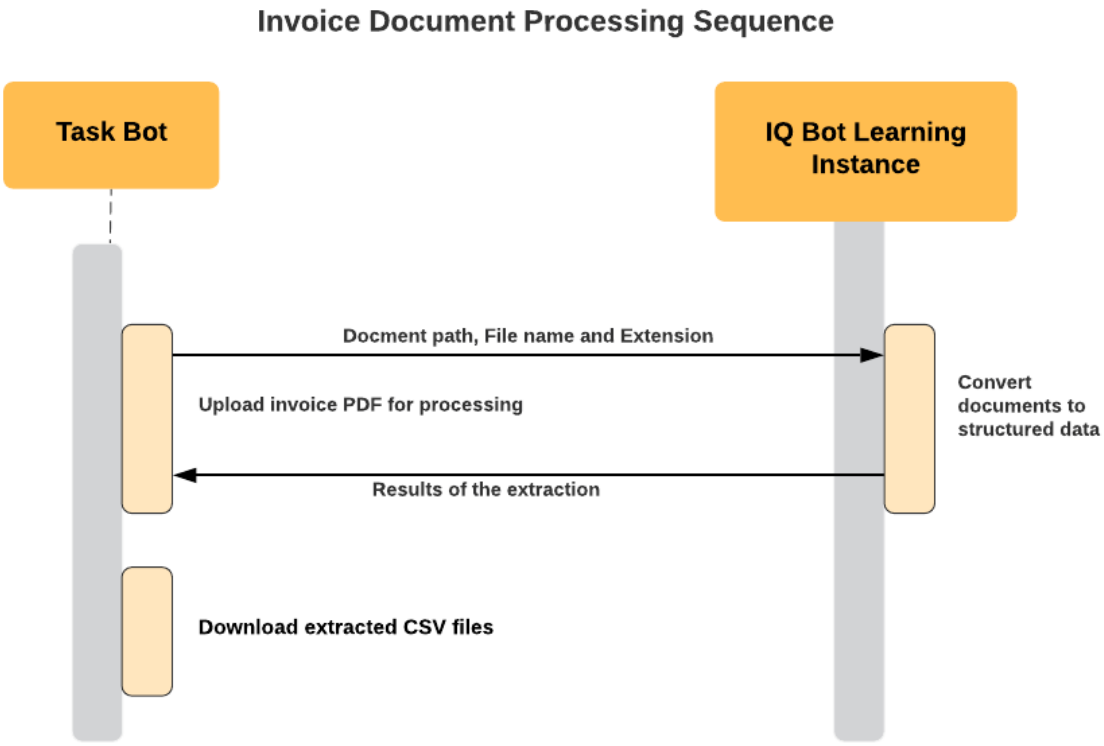
Project details

Processing invoices containing unstructured data in PDF files and changing them into structured data in the form of CSV files involves two steps. Let's take a look:

1. **Creating a learning instance**: We need to create a learning or training instance by feeding a few sample invoice documents for the AI (IQ Bot) to learn from. Then, we need to review and confirm or correct the mappings so that the AI learns the fields correctly. The IQ Bot is then ready to process invoices that are uploaded to it and convert them into structured CSV files. This can be seen in the following diagram:



2. **Upload and download from IQ Bot**: Once we have the learning instance, we can use a Task Bot to upload the invoices that we'd like to process to the IQ Bot learning instance. The IQ Bot processes the PDF documents and provides structured data in CSV format. We will use another bot to download those CSV files. Here is a sequence diagram showing this process:



Now, let's go through the project, starting with some groundwork.

Project groundwork

Let's set up a few things before we start working on the project. We will open Automation Anywhere A2019 and download the sample invoices that we will learn and process.

Opening the Automation Anywhere A2019 Control Room

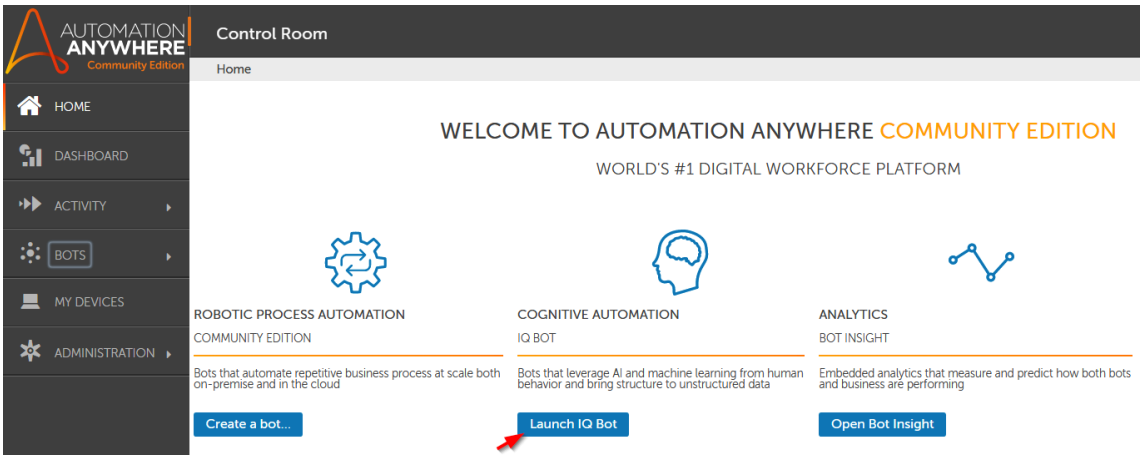
We will be creating an IQ Bot learning instance and some Task Bots so that we can invoke IQ Bot using the A2019 Control Room. So, open the A2019 Community Edition in your browser at https://community.cloud.automationanywhere.digital/#/login. Please log into the Control Room so that you end up on the Control Room's home page.

Now that we're in the A2019 Control Room, we can go to IQ Bot and gather the invoice samples.

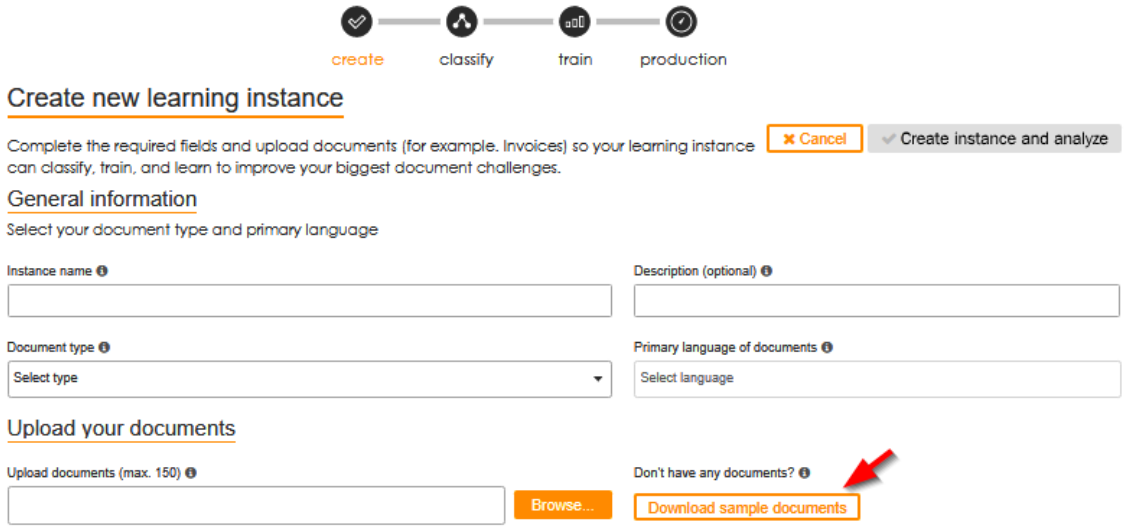
Downloading sample invoices

We will download and use the A2019 IQ Bot invoice samples so that it's easy for you to follow along:

1. To download Automation Anywhere samples, click on the Launch IQ Bot button from the Control Room home page, as shown in the following screenshot:



2. A2019 will open the IQ Bot home page in a new browser tab. Click on Get Started on the IQ Bot home screen to advance.
3. On the next screen (Create), you should find the option to Download sample documents, as shown in the following screenshot:



Click on the Download sample documents button. This will download a ZIP file containing all the document samples.

4. Extract the ZIP file and look for the Invoices folder. Copy that folder over to the project area.
5. Within this Invoices folder, create two folders -- Train and Test. We will put the invoices that we want to use for learning in the Train folder and the ones we want the bot to process in the Test folder. We can choose three typical formats and put them in the Train folder and place seven in the Test folder. You can choose different combinations and test the combinations for yourself.

Now that we have the sample invoices for the project, we can start creating the IQ Bot learning instance.

Creating the IQ Bot learning instance

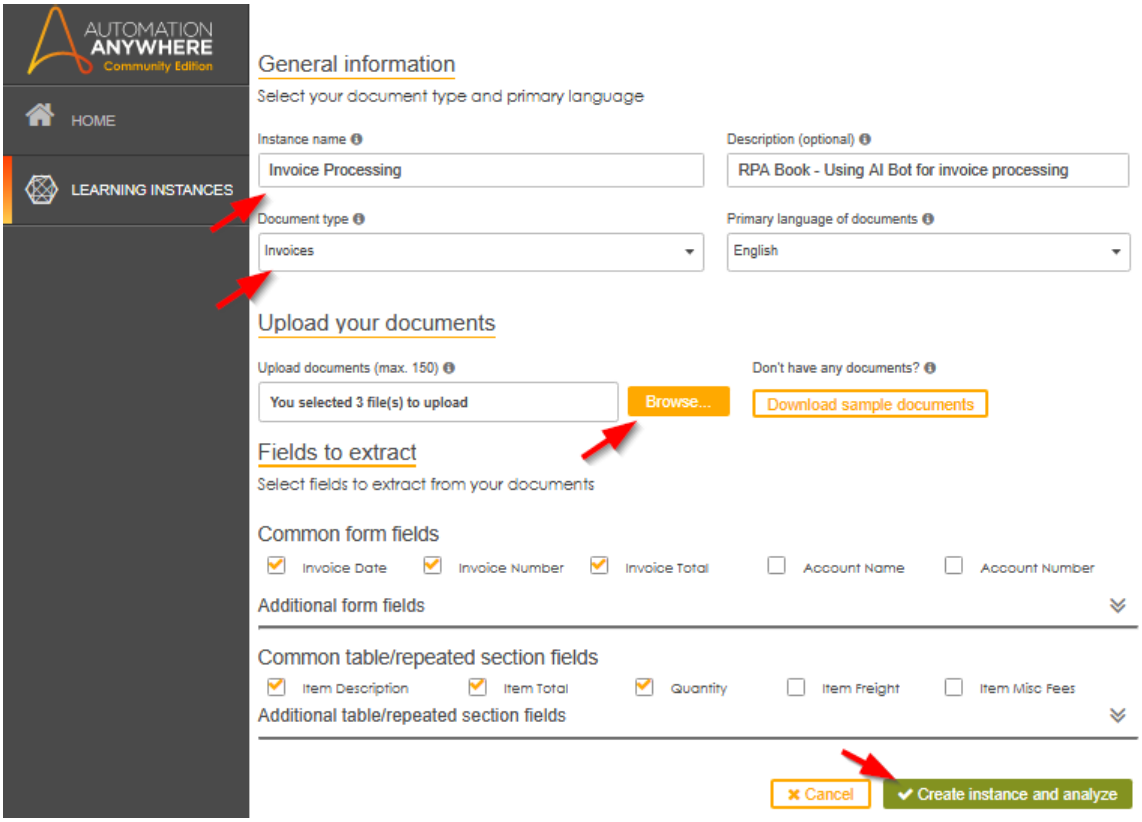
As we discussed in the introduction, IQ Bot uses AI to learn the format of the invoice. It uses what it's learned to process the rest of the invoices.

So, the first step is to create an instance that has been trained using the necessary invoice formats. Once we have the learning instance, we can upload the invoices to IQ Bot and convert them into structured data. Let's start by setting up the IQ Bot instance.

Setting up the initial IQ Bot learning instance

As part of the groundwork process, we opened the IQ Bot and went to the initial screen to create the learning instance. Go back to that page and pick up from where we left off:

1. On the Create screen, under General information, choose a name for the instance. Next, we have to provide a Document Type. We use this to tell the IQ Bot what type of documents we will be processing. Let's choose Invoices as we want IQ Bot to process invoices.
2. Under the Upload your documents section, we have to upload a few sample invoices for IQ Bot to learn from. Click on Browse and upload the invoices we put in the Train folder previously.
3. Finally, under Fields to extract, you can leave the default selected fields for the invoice as is. Click on Create instance and analyze:

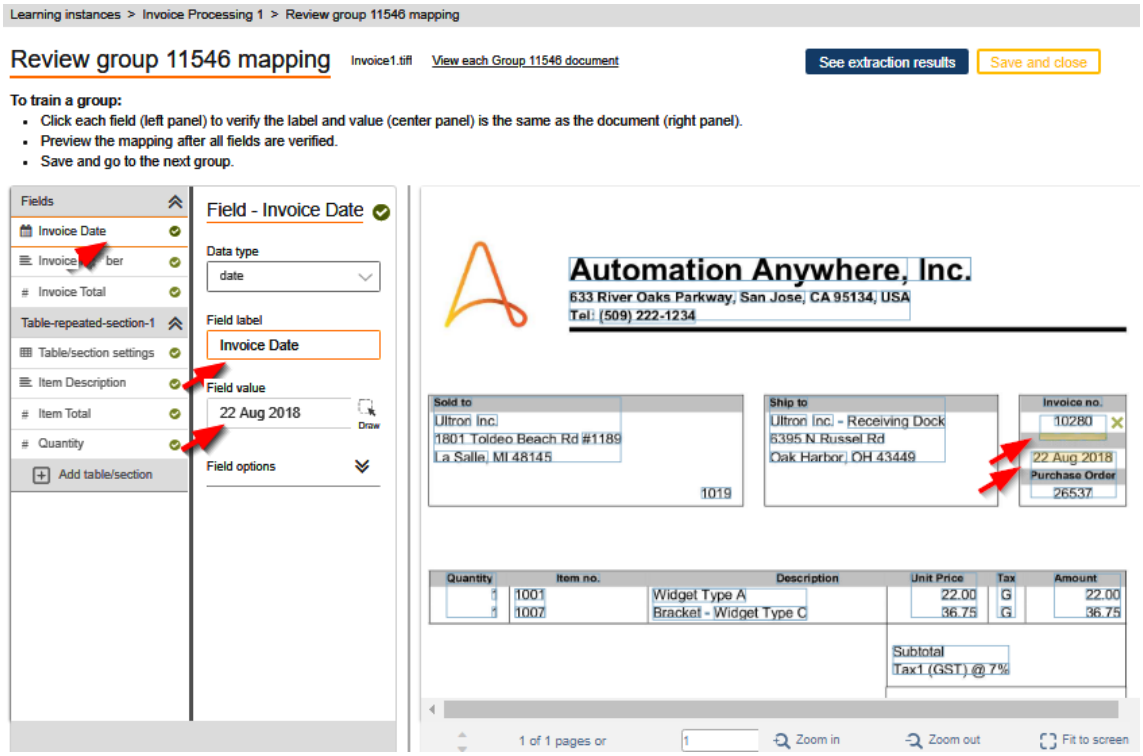


It will take IQ Bot a few minutes to analyze the documents and create the learning instance. After doing this, it will present us with a screen where we can review these changes and make any updates to the training process.

Reviewing and updating field mappings

IQ Bot presents us with a Review group with the mapping it has so far for the invoices we uploaded for training. This mapping is a starting point based on typical invoice formats. It is up to us to review and ensure that the fields and values are mapped correctly. Let's look at the steps:

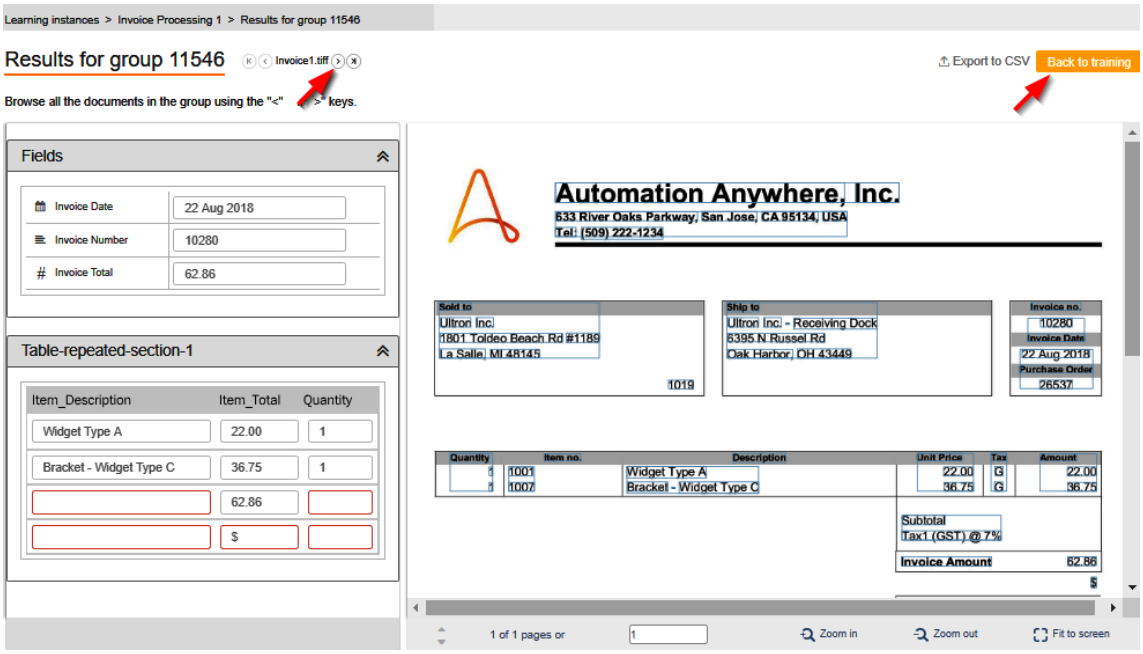
1. Here's what the review screen looked like for us. This may vary based on the training invoices you chose, though not by much if you also choose the Automation Anywhere sample invoices:



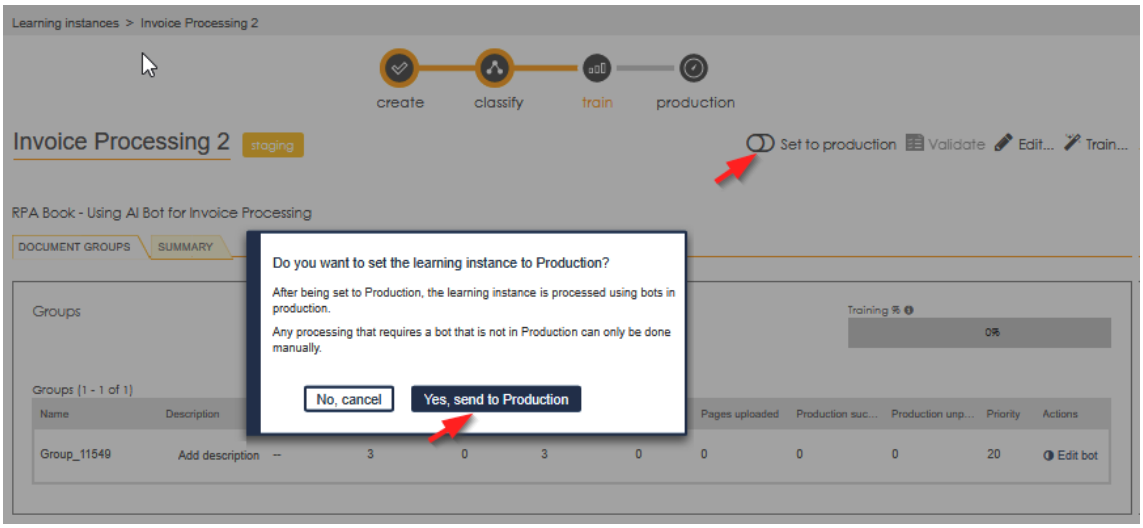
2. Look at each field and check whether the Field Label and Field Value options match with what is on the invoice on the right. For example, in the preceding screenshot, we have pointed out the fields and data to check for Invoice Date.

IQ Bot may classify the documents into different groups if there is more than one distinct format. We chose three similar types, so there is only one group. If there is more than one group, an extra button will appear at the top, near Save and close, so that you can review the other groups as well.

3. Next, click on the See extraction results button to verify that the data is being extracted as intended. You will see a screen similar to the one shown in the following screenshot so that you can verify whether the data is being extracted to the right fields. You can navigate to the results for the three invoices using the buttons at the top of the screen. Once you are satisfied with the extraction process, you can go Back to training by clicking the button shown in the following screenshot:



4. Once you are back on the Review group screen, click on Save and close. You will see a popup, asking whether you would like to save what you have trained currently. Go ahead and click on Save if you are satisfied with the training and the extraction you've done.
5. IQ Bot will then show you the learning instance and its group(s), as shown in the following screenshot. For us to use IQ Bot, we need to send to production using the toggle button shown in the following screenshot:



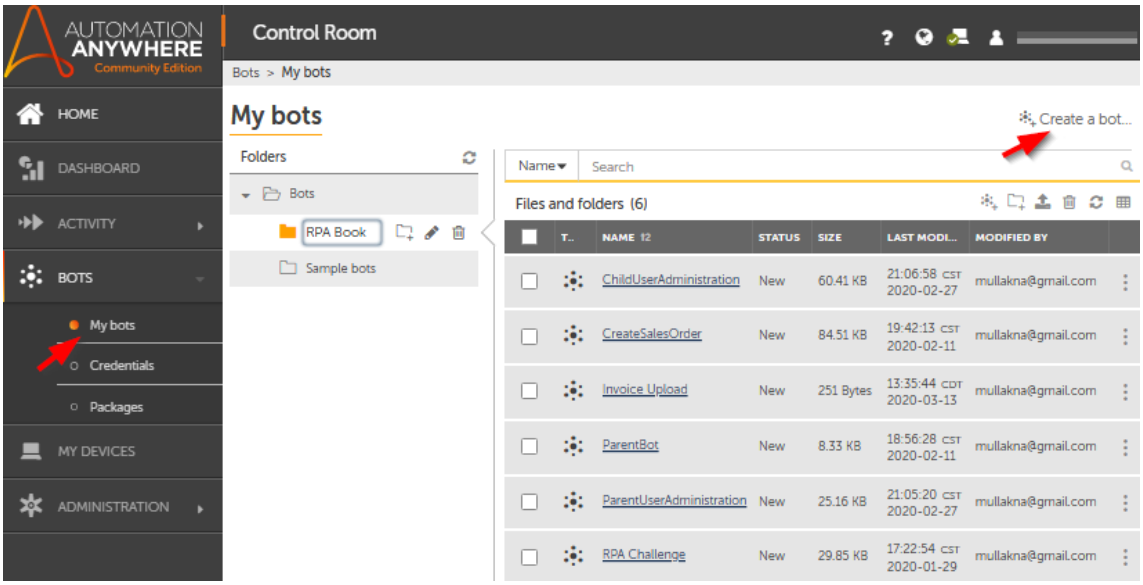
After some time, training will be at 100%. Now that we have a learning instance in production, we can upload the invoices we 'd like to process in IQ Bot.

First, let's create a Task Bot so that we can invoke and upload the invoices to IQ Bot.

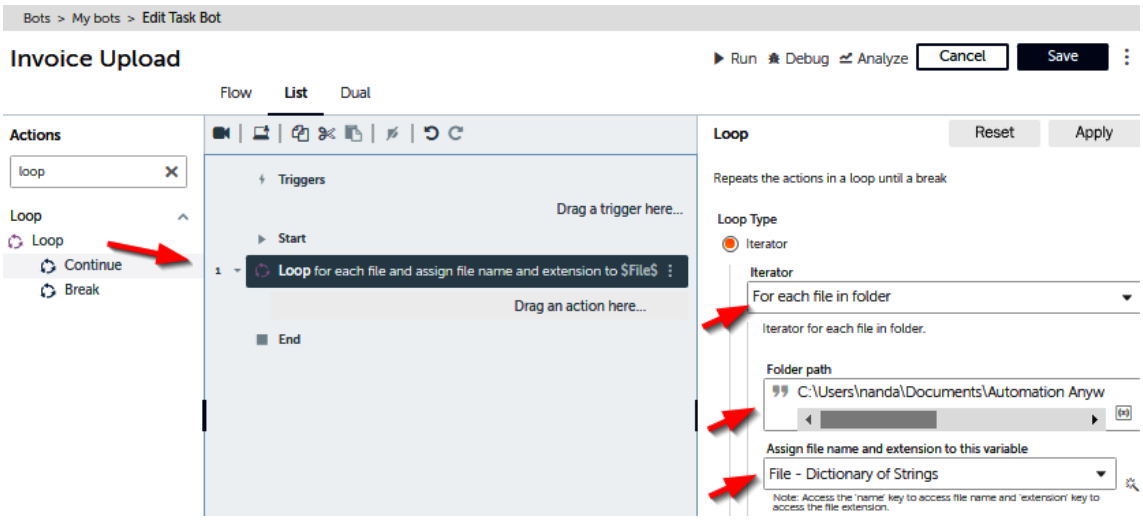
Uploading invoices to IQ Bot

Now, we are ready to process the rest of the invoices we placed in the Test folder. We will create a Task Bot that will loop through the Test folder and upload all the documents to IQ Bot. Follow these steps:

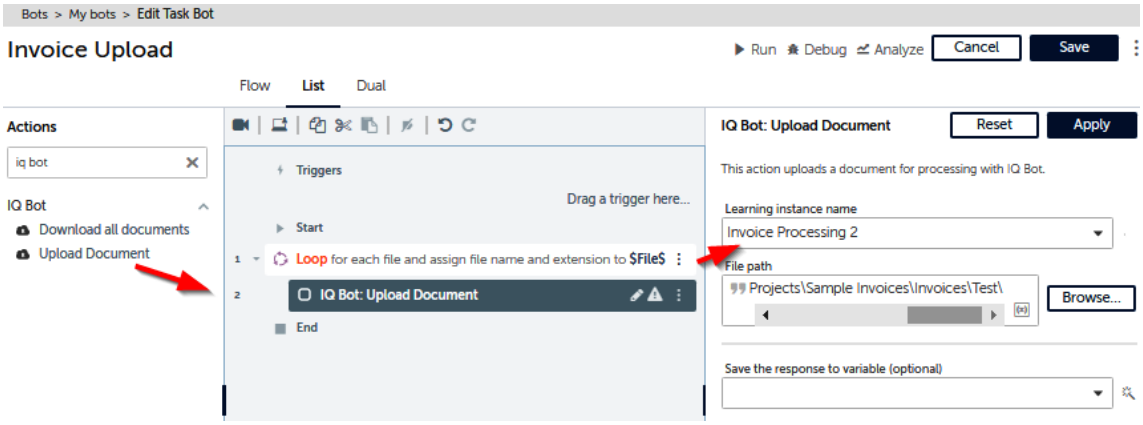
1. Let's go back to the Automation Anywhere A2019 Control Room home page. Note that this is different from the IQ Bot home page. Go to My Bots and then Create a bot, just like we did for our past A2019 projects. Name the bot Invoice Upload (or any name that you'd like to use to identify the bot):



2. On the new bot canvas, add a Loop action. Since we need to loop through each file in the Test folder, we'll set Iterator to For each file in folder. Provide the Folder path as the complete path to the Test folder. Finally, choose the wizard and add a Dictionary variable called File for the Assign file name and extension to this variable input box:

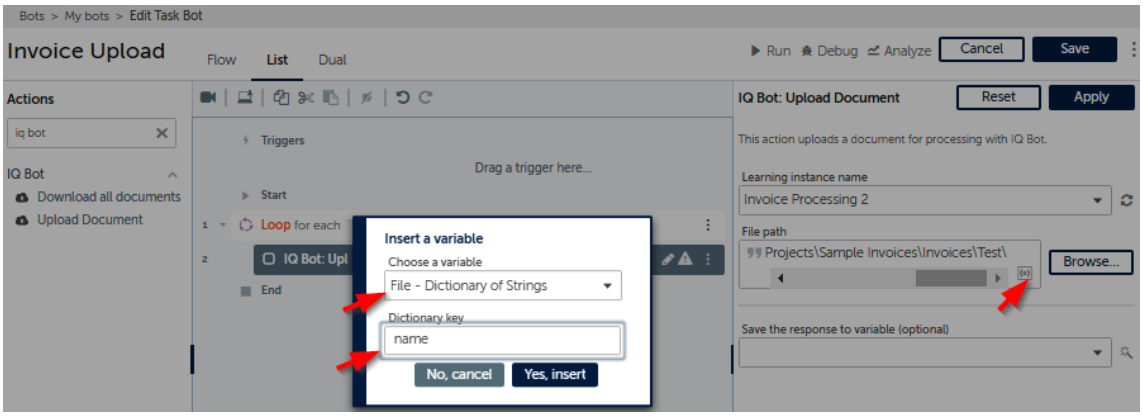


3. Next, add an IQ Bot step so that you can upload each of these documents. Choose the IQ Bot Upload Document Action. In the properties, choose the learning instance that we set to production in the previous section:



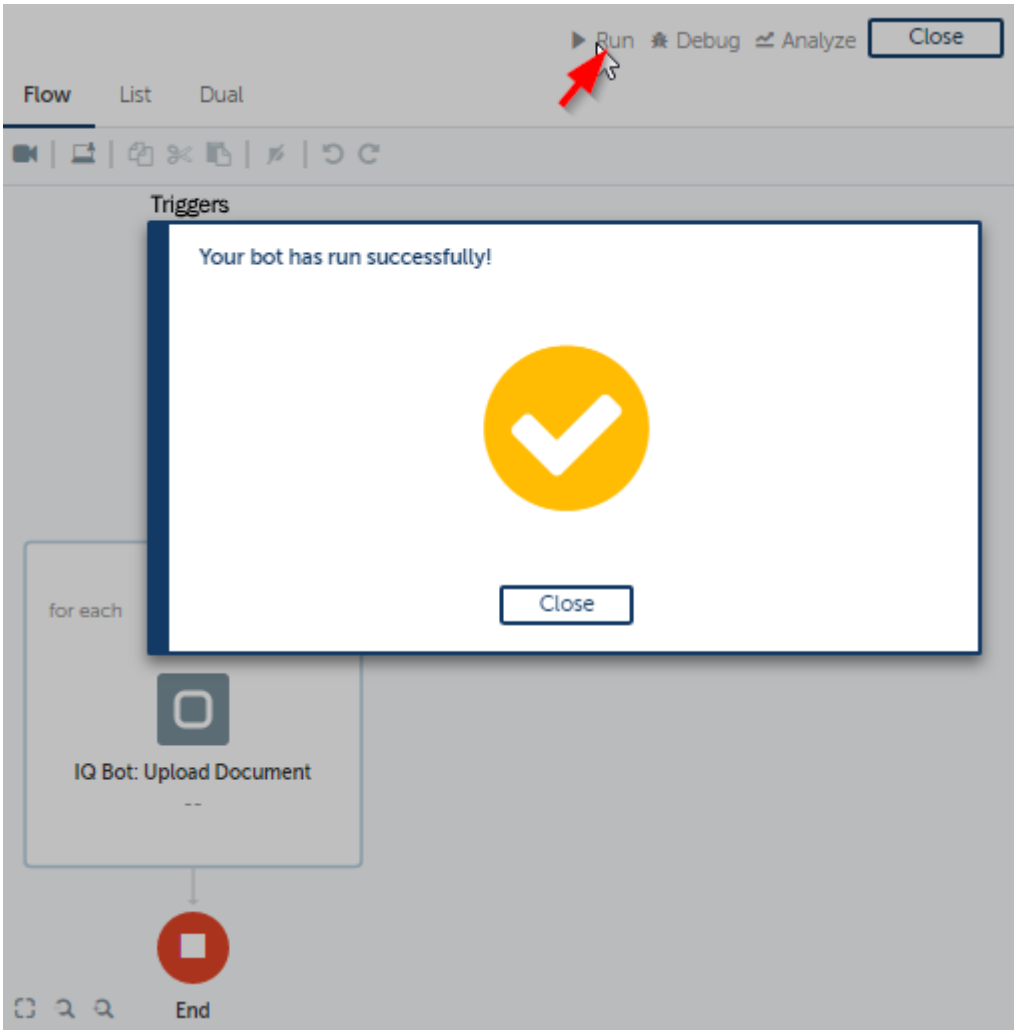
4. For the File path property, we need to construct the filename and append it to the path. To do so, we need to add the path to the Test folder, followed by a "\", and then click on the insert variable within the input box. Choose the File Dictionary variable and then type in name for the Dictionary key. Since we are constructing a filename with an extension, we'll need to add a "." after the File name variable. Click the insert variable again, choose File, and add a Dictionary key called extension. Your File path will be in the following format:

   `<Your File Path>\$File{name}$.$File{extension}$` This can be seen in the following screenshot:



You can also add a variable to capture the response from IQ Bot using the Save the response to variable option in the Upload Document activity, as shown in the preceding screenshot. Then, you can check whether the response is positive before uploading the next document.

5. Your uploaded Task Bot is ready. Save the bot and run it using the Run button. This will upload all the invoice documents we'd like to process with IQ Bot. If all goes well, you will receive a message stating that your bot ran successfully:

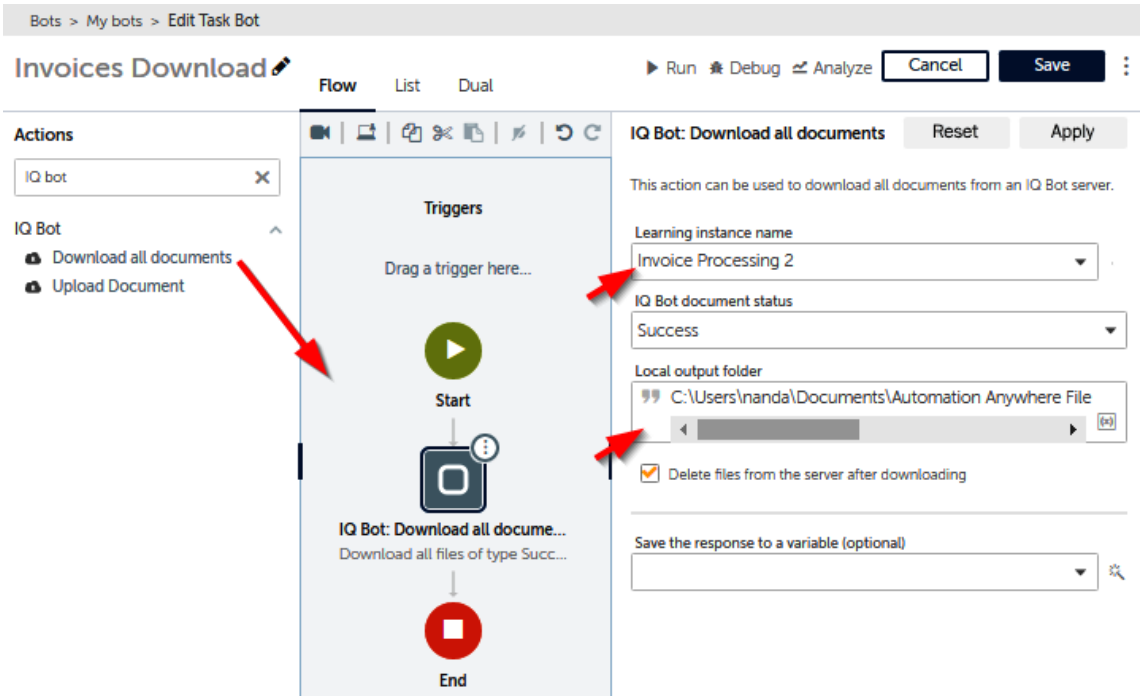


So far, IQ Bot has taken all the invoices from the Test folder and converted them into structured data. Now, we need to download them.

Downloading structured data from IQ Bot

Now, let's download the CSV files that were generated by IQ Bot. These CSV files contain the invoice data from the mapping we created in the learning instance. To create this Task Bot, follow these steps:

1. Go to My Bots on the left panel and select Create a bot, just like we did in the previous section. Name it Invoice Download.
2. We just need one Action to download the files from IQ Bot. Let's look up and add the IQ Bot Download all documents Action. In its properties, choose the learning instance we created earlier. For the Local output folder, add the path where you'd like the bot to place the processed CSV files:



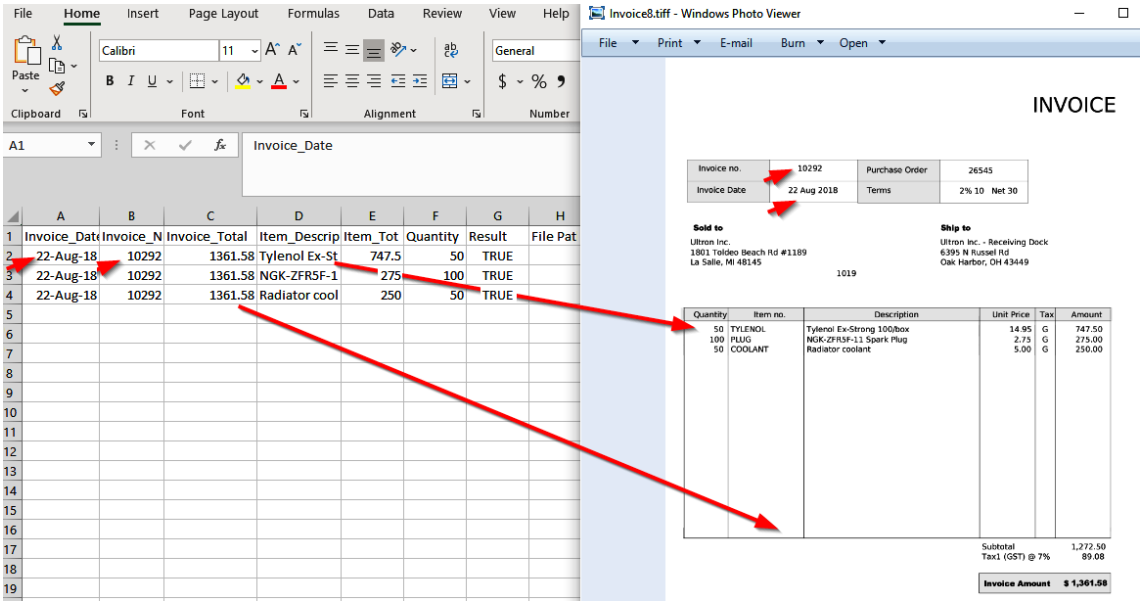
3. Save the bot and run it. Once the bot has run successfully, go to the processed CSV files folder and check whether you have the files. The bot will have processed all the invoices that matched the format that we trained it on.

Now that we have the structured data downloaded, let's verify the data with the corresponding invoices.

Checking the automation

Let's compare the structured data output from the bot with the unstructured data from the invoices. This way, we can test that our project works.

Open the CSV file from the processed files folder. Also, open the corresponding invoice. The bot will have named the CSV file so that the invoice's filename is at the end. Place them side by side to compare them, as shown in the following screenshot:



	A	B	C	D	E	F	G	H
1	Invoice_Dat	Invoice_N	Invoice_Total	Item_Descrip	Item_Tot	Quantity	Result	File Pat
2	22-Aug-18	10292	1361.58	Tylenol Ex-St	747.5	50	TRUE	
3	22-Aug-18	10292	1361.58	NGK-ZFR5F-1	275	100	TRUE	
4	22-Aug-18	10292	1361.58	Radiator cool	250	50	TRUE	

You can compare each of the invoice fields to the columns in the CSV file. Do this comparison for the rest of the files that were generated. If all goes well, all the fields should match perfectly.

These CSV files can now be used as input for an automation process that needs to use the invoice data. IQ Bot Community Edition can process many standard document formats such as invoices, purchase orders, bank statements, credit memos, and utility bills. There are many more formats in the Enterprise version.

So, if we were to repeat these steps for purchase orders using a sample format, we could take the structured data and put it in a purchase order application.

This was our last project with Automation Anywhere. Let's do a quick recap.

Automation Anywhere projects -- recap

With this project, we completed five projects with Automation Anywhere A2019 that have increased in complexity. Here is what we've covered:

- We started with the Automation Anywhere A2019 platform by solving an RPA challenge. This included performing basic automation, along with handling dynamic elements in forms.
- Then, we learned how to use web automation by creating sales orders in the Apptivo application.
- Next, we learned about how to perform user administration with bots by creating new users in a SaaS application.
- Then, we completed an exciting project that sent emergency text messages using the Twilio API.
- In this final project, we learned how to use AI to extract meaningful data from scanned documents using Automation Anywhere IQ Bot.

With that, we have covered five different projects using Automation Anywhere and UiPath!

Summary

In this lab, we learned how to use AI with RPA for document processing.

Processing documents such as purchase orders and invoices is one of the common yet difficult problems that arises when it comes to automation. So, in this lab, we looked at how to crack that problem with AI.

Once AI has processed these documents into structured data, it opens up many automation use cases for downstream processing. For example, invoice data output could be entered into the Apptivo application, which we used previously in this course.

Now that we have come this far, we encourage you to try out what you've learned for yourself. In fact, there are many more use cases that you can automate based on the projects we completed in this course.

This is the last lab in this course. We had great fun creating these projects and have included provided the code on GitHub. We hope you've enjoyed working on the projects as much as we've enjoyed guiding you through them. We're sure you've faced some difficulties but have come out the other end as a better RPA practitioner.

Hopefully, we will get to write more books on this subject. When we do, we hope to see you there -- or somewhere on the web!