LECTURE 05.
UI INTERACTIONS IN UIPATH

Robotic Process Automation
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Elective Course, 2019-2020, Fall Semester

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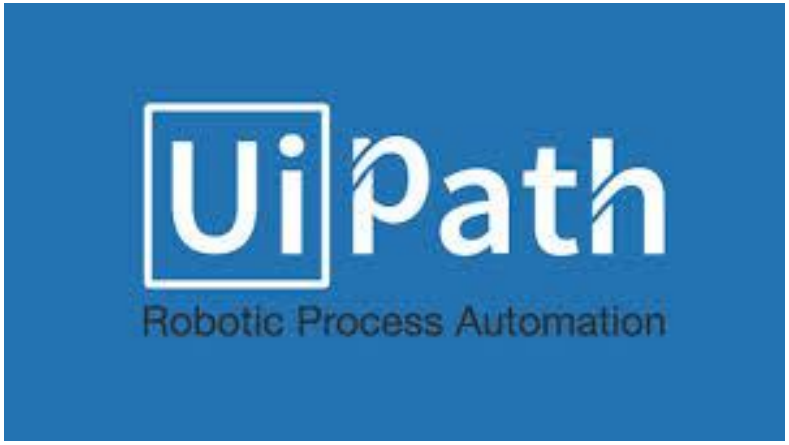
Acknowledgements

This course is presented to our Faculty with the support of UiPath Romania.



Contents

UI Interaction. Types

- automations consist of different kinds of actions that may interact with UI elements;
- there are two types of interactions:
  - **Input** – inserting data into an application;
  - **Output** – reading data from an application.

Input Actions

- **Clicks**
- **Text typing**
- **Keyboard shortcuts**
- **Mouse hover**
- **Clipboard actions (Paste)**

Output Actions

- **Getting text**
- **Finding elements**
- **Identifying images**
- **Clipboard actions (Copy)**

UI Input Methods. Details

- *for humans:*
  - the only way to present **input actions** is to use **clicks**, **types** and so on;
  - **devices used:** the mouse, the keyboard;
- *for robots:*
  - there different ways to present **input actions**;
  - **actions that simulate devices**: mouse, keyboard, OS message sending, etc.
    - UiPath supports 3 input methods.

UiPath Input Methods. Types

- in UiPath there are 3 input methods available:

Default method:

- it replicates the **human method**, e.g., the mouse cursor moves on the screen;

Send Window Messages:

- it replicates the **messages that an application receives** when the user utilizes the keyboard and the mouse;

Simulate Type/Click:

- it acts like a developer programmatically changing the value of an editable field, using **the technology of the target application**.

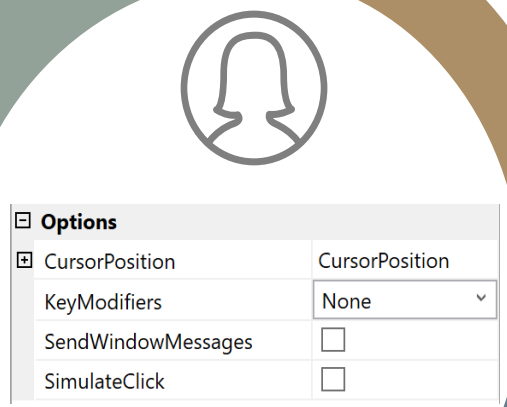
UiPath Input Methods. Default

Working

- **Clicks:** The mouse cursor moves across the screen;
- **Typing:** The keyboard driver is used to type individual characters;

Implications

- Attended user cannot touch the mouse or keyboard during the automation;
- it has a **lower speed** and load times can impact accuracy



Strong points

- it supports special keys like **Enter**, **Tab**, and other **hotkeys**

Limitations

- **it does not automatically erase previously written text; it writes after it;**
- **it does not work in the background.**

UiPath

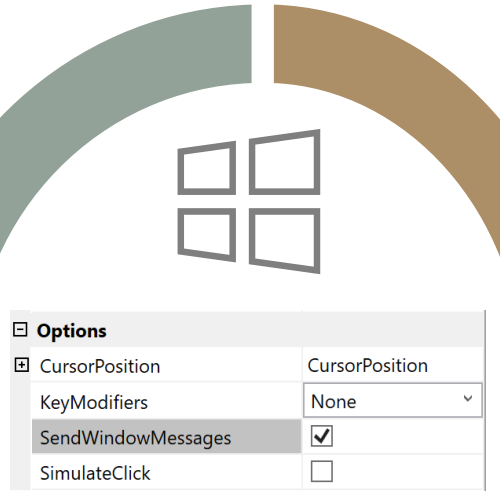
UiPath Input Methods. Send Window Messages

Working

- it replays the window messages that the target application receives when the mouse/keyboard is used;
- **Clicking** and **typing** occur instantly;

Implications

- **it works in the background;**
- it is comparable to the **Default** method in terms of speed;



Strong points

- Supports special keys like **Enter**, **Tab**, and other **hotkeys;**
- **Users can work on other activities during the execution of the automated processes;**

Limitations

- **it does not automatically erase previously written text;**
- **it works only with applications that respond to Window Messages.**

UiPath Input Methods. Simulate Type/Click

Working

- it uses the technology of the target application to send instructions;
- **Clicking** and **typing** occur instantly;

Implications

- **it works in the background;**
- **actions are a lot faster,** but **there are some compatibility limitations;**

Strong points

- **it can automatically erase previously written text;**
- Users can work on other activities during the execution of the automated processes.

Limitations

- **it does not support special keys like Enter, Tab, and other hotkeys;**
- **it has a lower compatibility than the other 2 methods.**

UiPath

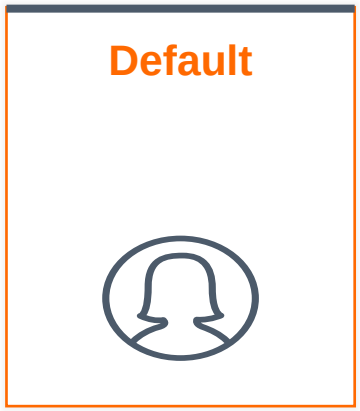
Demo 1. Input Methods Applied

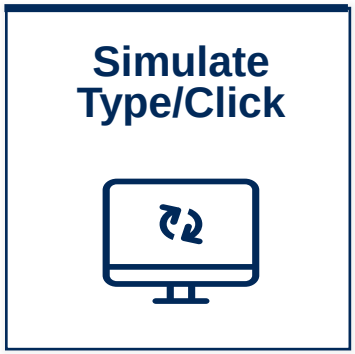
- **User Basic or Desktop recorder to create a process that performs the following actions:**
  - **1. o*pen* the Notepad Application;**
  - **2. *type* "Happy Tuesday!";**
  - **3. *minimize* the Notepad window;**
  - **4. *restore* the Notepad window;**
  - ***5. type* "Sent on Tuesday.";**

- **Perform the following tasks:**
  - **Swap steps 4 and 5;**
  - **Switch between the three input methods. Discuss the followings:**
    - ***Is the field blank?***
    - ***Are hotkeys handled correctly?***
    - ***How fast does the automation work?***
    - ***Does the automation work in the background?***

UiPath Input Methods. Summary

- input methods available in UiPath:





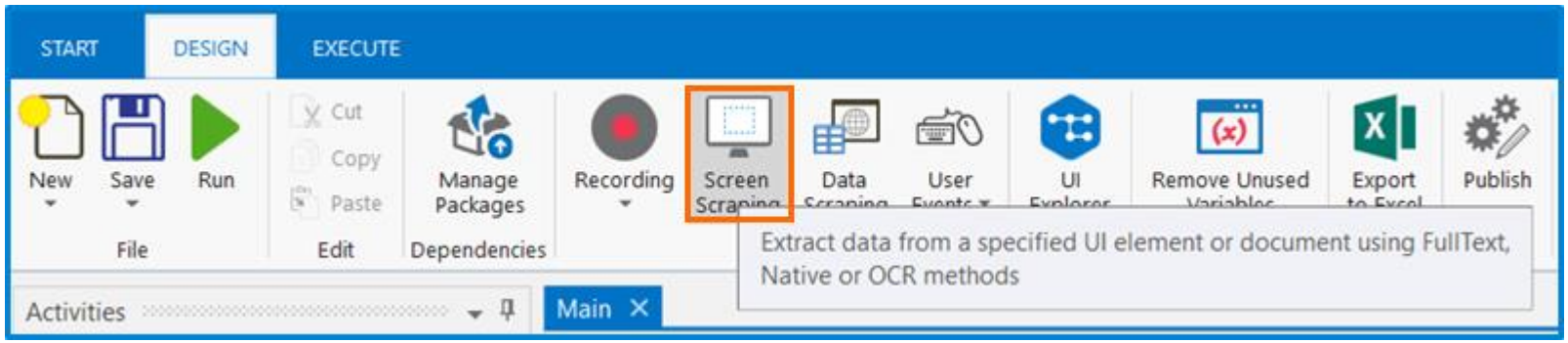
	Compatibility	Background	Speed	Hotkeys	Empty Field
Default	100%	NO	50%	YES	NO
Window Messages	80%	YES	50%	YES	NO
Simulate Type/Click	99% (for Web Apps) 60% (for Desktop Apps)	YES	100%	NO	YES

UI Output Methods. Details

- *for humans:*
  - **output action** are **read** and **process** the data resulted from applications and files;
- *for robots:*
  - there different ways to present **output actions**;
    - **activities** that simulate output actions use **variables** and **arguments**;
    - **tools** that take out data (simulate read) from screens and documents;
      - they enable data extraction from UI elements the automation workflows interact with;
      - UiPath supports 3 output (screen scraping) methods;

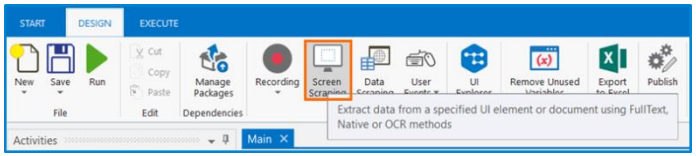
UiPath Screen Scraping Wizard. Details

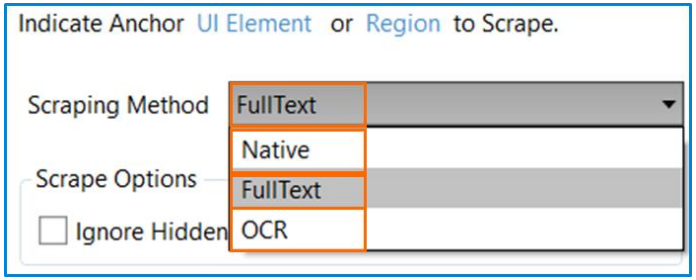
- the **Screen Scraping Wizard** enables:
  - **to point** at a UI element and
  - **to extract text** from it, using one of the **three output methods**;
- the steps to perform screen scraping are:
  - 1. start the Screen Scraping Wizard;
  - 2. select the UI element in Computer Vision mode;
  - 3. select the screen scraping method from the options panel;
  - *(optional)* 4. if required, switch to another output method that gets the needed results.



UiPath Screen Scraping Wizard. Steps

- Steps:
  - 1. the **Screen Scraping Wizard** is started from the **Design Ribbon** in UiPath Studio.
  - 2. the screen goes in *Computer Vision mode*, highlighting the UI elements that it identifies with blue;
    - select the UI element;
    - UiPath Studio *automatically* choses a screen scraping method;
  - 3. after it finishes extracting the text, the wizard shows the outcome;
    - the user is allowed to switch between the 3 output methods and customize using the properties;
    - the **Refresh** button can be used to see the outcome according to the new settings.





UiPath Output Methods. Types

- in UiPath there are 3 output methods available:

FullText

Native

OCR

FullText method:

- **it is the default output method in most cases;**
- **it is the fastest method, has 100% accuracy** and **can work in the background;**
- moreover, it is able to extract hidden text (for example, options in a drop-down list). However, **it doesn't support Citrix and doesn't capture text position and formatting.**

Native method:

- **it is compatible with applications that use the Graphics Design Interface, the Microsoft API responsible for representing graphical object;**
- **it can extract the text position (coordinates)** and **formatting; it has 100% accuracy;**
- **its speed is lower than FullText method** and **it cannot work in the background**;
- **like FullText method, it doesn't support Citrix.**

OCR (Optical Character Recognition) method:

- **it is the only one that works with Citrix;**
- **its technology relies on recognizing each character just like we recognize faces in a photography**;
- **like Native method, it also captures the text position;**
- **it cannot work in the background, cannot extract hidden text, and its speed is by far the lowest;**
- its accuracy varies from one text to another, and changing settings can also improve the results.

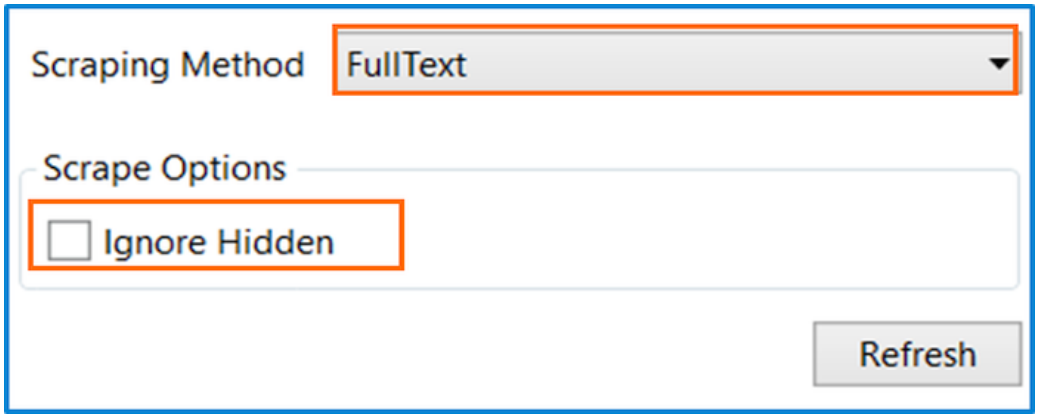
FullText Method. Details

FullText method: captures all the text from a terminal screen;

- **it is the default output method in most cases;**
- **it is the fastest method, has 100% accuracy** and **can work in the background;**
- moreover, it is able to extract hidden text (for example, options in a drop-down list). However, **it doesn't support Citrix and doesn't capture text position and formatting.**

Ignore Hidden:

- when this check box is selected, the hidden text from the selected UI Element is not copied.



UiPath

Native Method. Details

Native method:

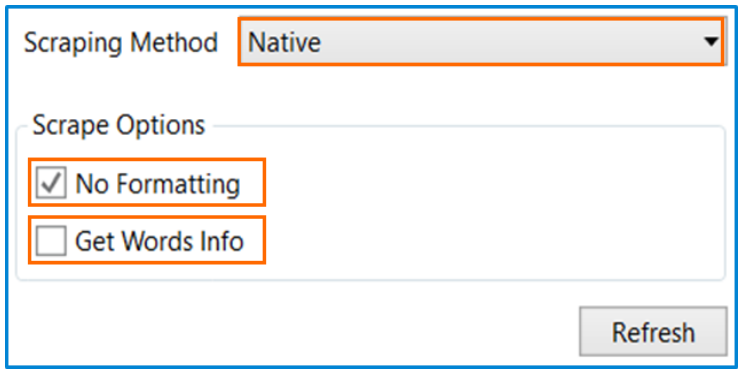
- **it is compatible with applications that use the Graphics Design Interface, the Microsoft API responsible for representing graphical object;**
- **it can extract the text position (coordinates)** and **formatting; it has 100% accuracy;**
- **its speed is lower than FullText method** and **it cannot work in the background**;
- **like FullText method, it doesn't support Citrix.**

No Formatting:

- when this check box is selected, the copied text does **not** extract formatting information from the text, i.e., font, color, similar to **FullText** method;

Get Words Info:

- when this check box is selected, the screen coordinates of each word are extracted;
- It supports several separators; if the **Custom Separator** field is empty all kwon separators are used.



OCR Method. Details

- the **OCR output method**
  - uses the OCR technology (**Optical Character Recognition**) for:
    - extracting information from virtual environments (Citrix or Remote Desktop);
    - “reading” text from images;
  - **it attempts to recognize each letter or given image in the target document;**
- it has two default engines:
    - **Google Tesseract**;
    - **Microsoft MODI**.

OCR (Optical Character Recognition) method:

- **it is the only one that works with Citrix;**
- **its technology relies on recognizing each character just like we recognize faces in a photography;**
- **like Native method, it also captures the text position;**
- **it cannot work in the background, cannot extract hidden text, and its speed is by far the lowest;**
- its accuracy varies from one text to another, and changing settings can also improve the results.

Google Tesseract OCR Engine. Details (1)

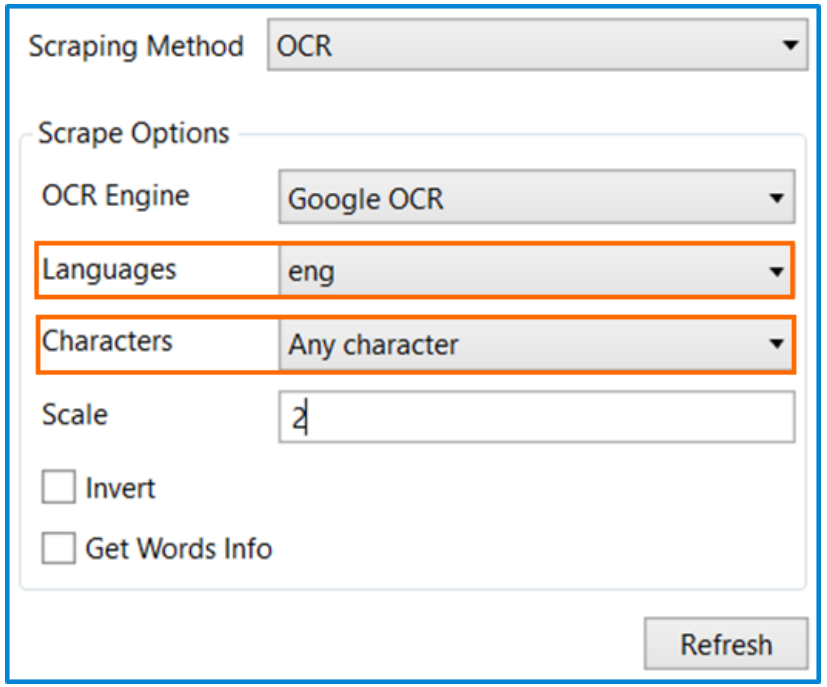
- the **Google Tesseract OCR** engine
  - is more effective with **character recognition** on **small size areas**;
  - it offers **multiple customization** options.

Languages:

- it enables language change for the scraped text;
- by default, English is selected; others are available at https://github.com/tesseract-ocr/tessdata;
- downloaded and copied it in the 'tessdata' subfolder of the UiPath installation folder;

Characters:

- it enables the selection of type of characters to be extracted: any character, numbers only, letters, uppercase, lowercase, phone numbers, currency, date and custom;
- **Custom** option two additional fields, **Allowed** and **Denied**, which allow the user to choose which types of characters to scrape and which to avoid.



Google Tesseract OCR Engine. Details (2)

Scale:

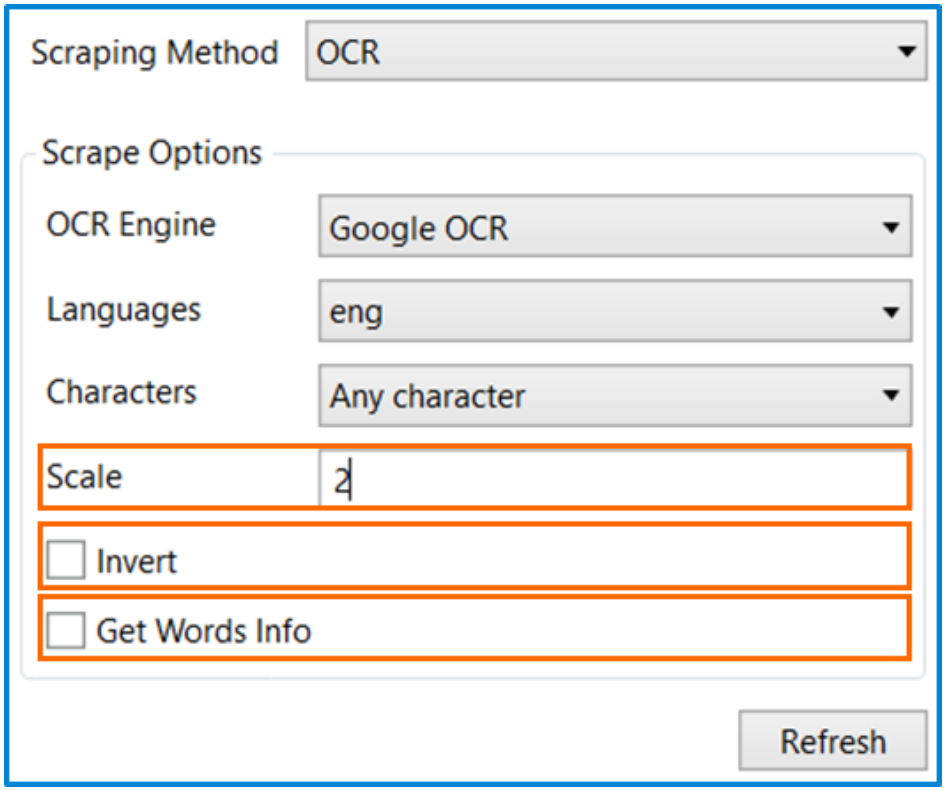
- it helps the user specify the scale of the text to be scraped;
- if the results are not satisfactory, it is recommended to change the scale both ways (up, down) and see if it makes any difference;

Invert:

- when this check box is selected, the colors of the UI element are inverted before scraping;
- useful for: **darker themed applications**, **websites** and **scanned documents;**

Get Words Info:

- it gets the on-screen position of each scraped word.



Microsoft MODI OCR Engine. Details

- the **Microsoft Office Document Imaging (MODI)**
  - is best used **to read Microsoft fonts** on **large size areas**;
  - it offers multiple customization options.

Languages:

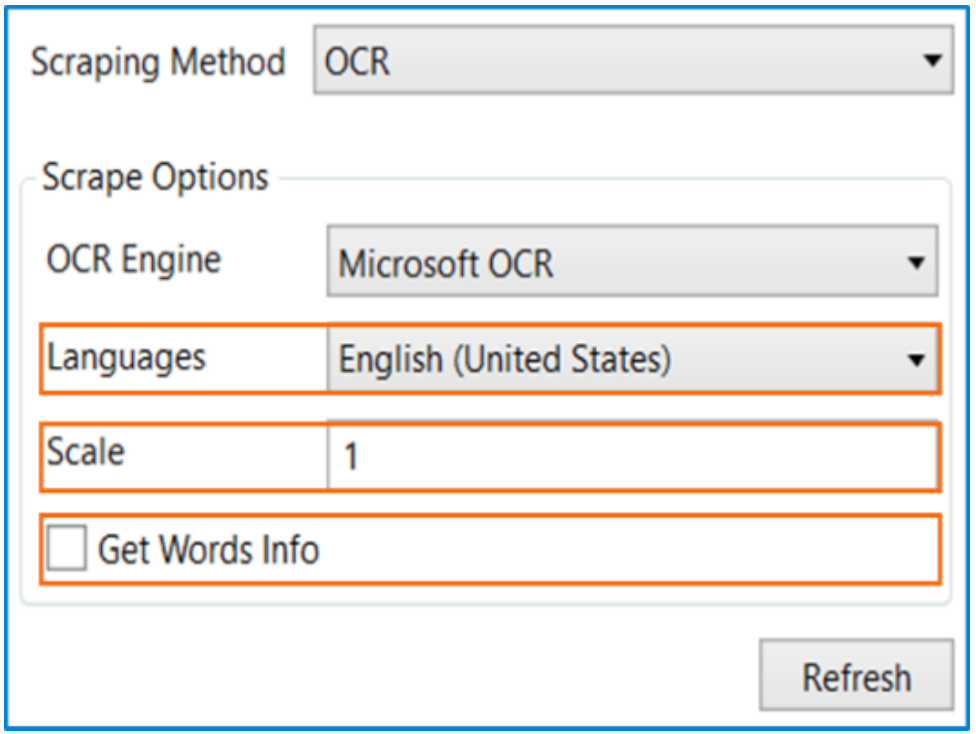
- it enables language change for the scraped text;
- by default, English is selected;
- once the languages are added using the Windows Settings (using the Region & language sub-menu), they can be selected as options in Studio.

Scale:

- it helps the user specify the scale of the text to be scraped;

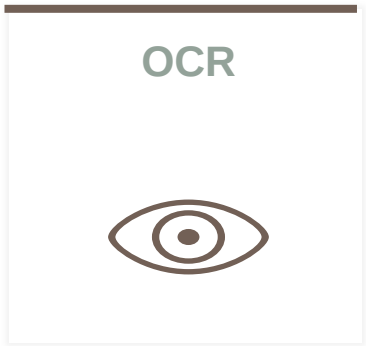
Get Words Info:

- it gets the on-screen position of each scraped word.



UiPath Output Methods. Summary

- in UiPath there are 3 output methods available:



	Speed	Accuracy	Background	Extract Text Position	Extracts Hidden Text	Supports Citrix
FullText	10/10	100%	YES	NO	YES	NO
Native	8/10	100%	NO	YES	NO	NO
OCR	3/10	98%	NO	YES	NO	YES

UiPath Output Methods. Activities Overview

- the activities associated to the output methods are presented below;

Output Method	Manual action/Activity
Basic Recording	**Get Text** activity
FullText	**Get Full Text** activity
Native	**Get Visible Text** activity
OCR	**Get OCR Text** activity

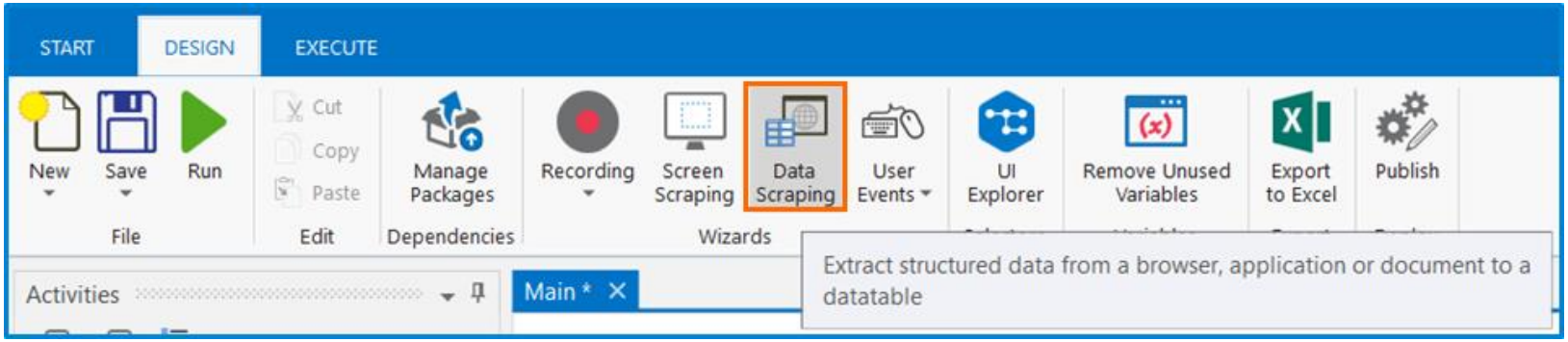
Demo 2. Output Methods Applied

- Use Screen Scraping Wizard to take out data from:
  - a .txt file open in Notepad and having the following content:
    - 1. “Flow Chart” and “Assign” activity.
    - 2. “Write Line” and “Do While”.
    - 3. “Sequence” and “Input Dialog” activity.
    - 4. “If” activity and how to set conditions.
    - 5. Display output in “Message Box”.
  - a folder content from a Total Commander application window;
  - the www.cs.ubbcluj.ro web page opened in Chrome browser
    - an image, a text;
  - the www.imdb.com web page opened in Chrome browser;
  - The IrfanVIewer application with an image that contains the text “*şi a mers cale lungă. Ţintea vizuina monstrului numaidecât.*“

- Perform the following tasks:
  - Switch between output methods and their options.

Data Scraping. Details

- **Data Scraping** is the **process of extracting structured data**
  - from a **browser, application, or document**
  - to a **database, .csv file,** or **Excel spreadsheet**;
- **Data Scraping** is a functionaity of UiPath Studio for extracting structured information and storing it in a **DataTable** variable.



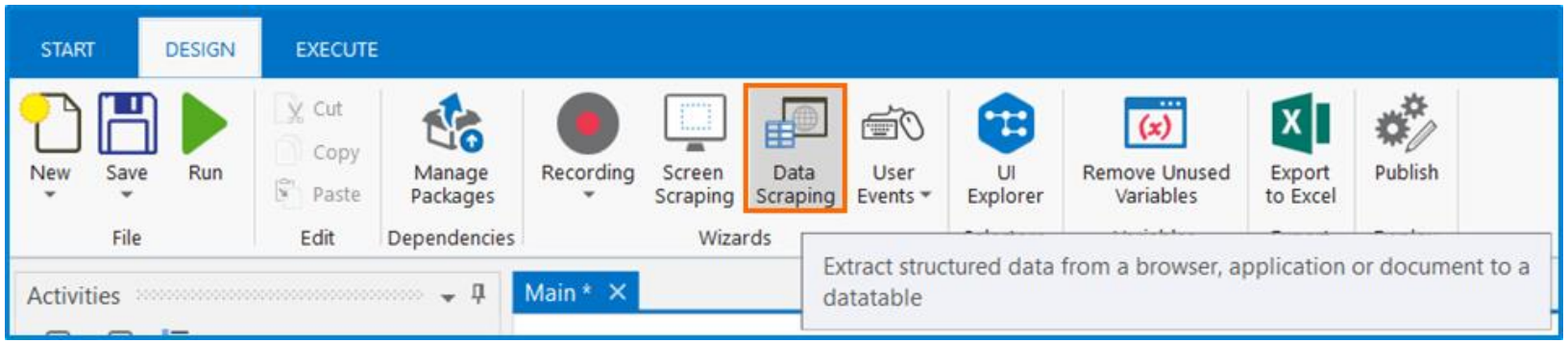
Structured Data. Details

- **Structured data**
  - is a specific kind of information that is **highly organized** and is presented in a **predictable pattern**.

- For example, **Announcements** page available on www.cs.ubbcluj.ro consists of a list of elements having the same structure:
  - a title;
  - a date;
  - a content.

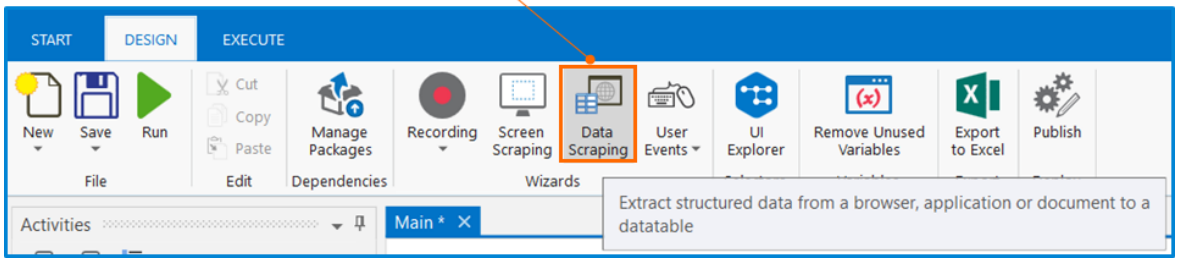
Extract Wizard. Details

- **Extract Wizard** consists of the following steps:
  - 1. Wizard opening;
  - 2. Field selection;
  - 3. Column naming;
  - 4. Pattern preview;
  - 5. Correlated data (where steps 2-->5 repeat as required);
  - 6. Multiple page selection;
  - 7. Extraction of results.

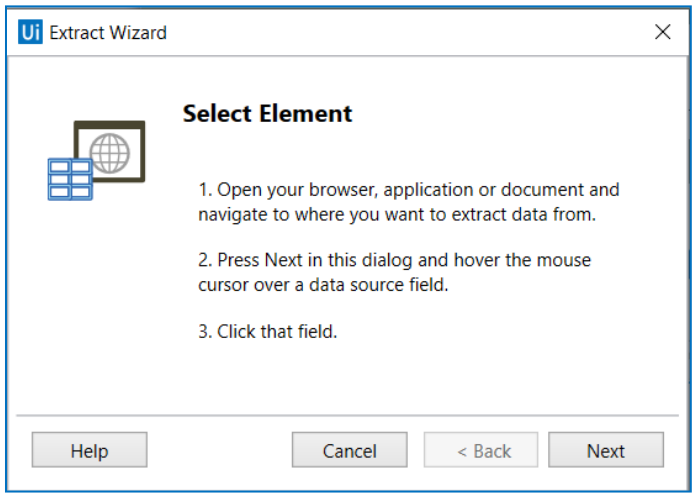


Extract Wizard. Step 1

Wizard opening → **Field selection** → **Column naming** → **Pattern preview** → **Correlated data** → **Multiple page selection** → **Extraction of results**

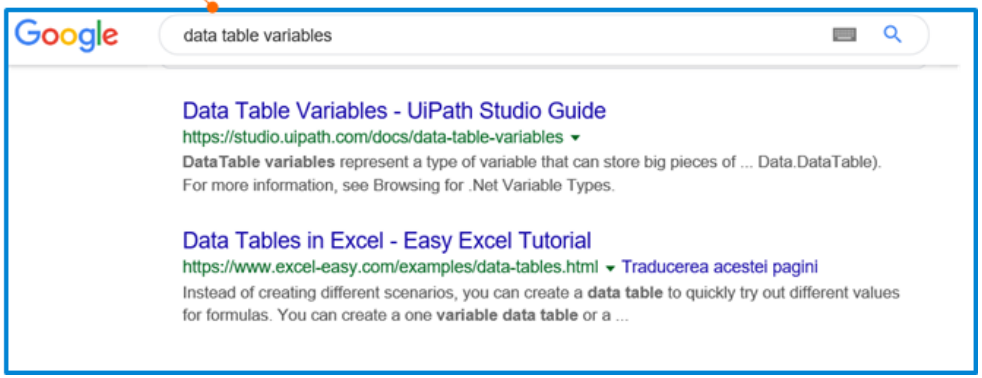


- the **Extract Wizard** window prompts the user to open the browser, application or document to scrape data from
- after 'Next' button is clicked, the screen enters in the *Computer Vision mode*, where each UI element that is identified is shown in **a blue screen with a yellow frame**.



Extract Wizard. Step 2

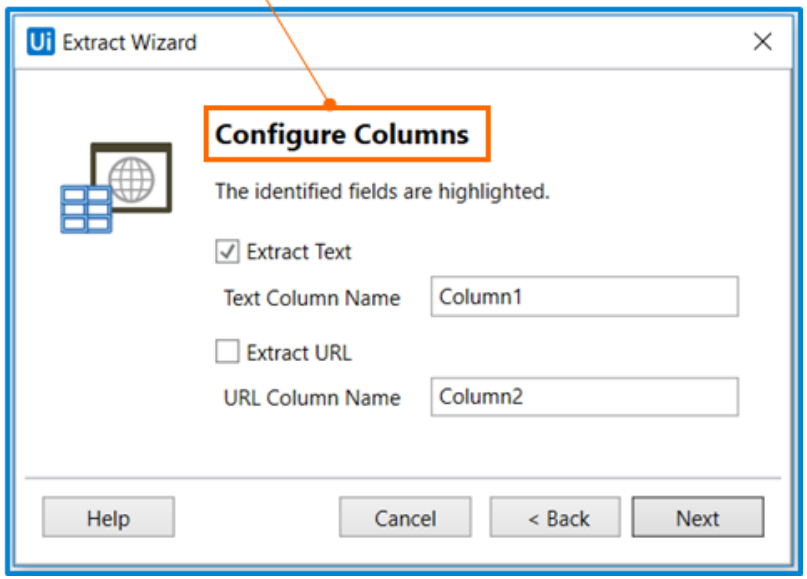
Wizard opening → **Field selection** → Column naming → Pattern preview → Correlated data → Multiple page selection → Extraction of results



- the user selects the **first entry** and **last entry of the field** in the web page, document, or application that they want to extract data from.

Extract Wizard. Step 3

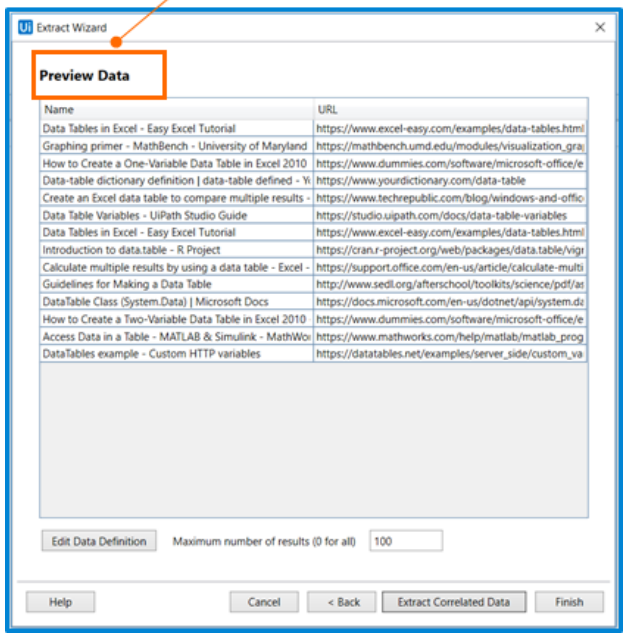
Wizard opening | Field selection | **Column naming** | Pattern preview | Correlated data | Multiple page selection | Extraction of results



- the user can customize **column header names** and **choose whether or not to extract URLs**.

Extract Wizard. Step 4

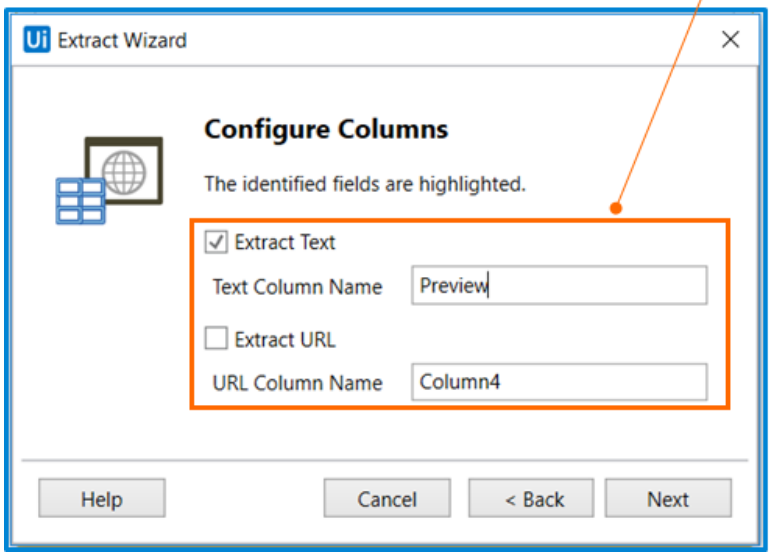
Wizard opening → Field selection → Column naming → **Pattern preview** → Correlated data → Multiple page selection → Extraction of results



- after the 'Next' button is clicked, a preview of the data is shown, and the user may change the **order of the columns** and **specify the maximum number of entries to be extracted** (default = 100, 0 means extracting all the available the results).

Extract Wizard. Step 5

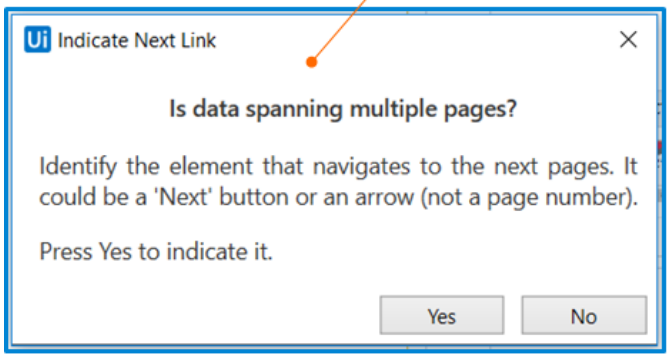
Wizard opening | Field selection | Column naming | Pattern preview | **Correlated data** | Multiple page selection | Extraction of results



- this is particularly useful when the user wants to extract multiple fields;
- after each field is indicated, the user can add the name of the column;
- the operation of **extracting correlated data can be repeated multiple times**.

Extract Wizard. Step 6

Wizard opening → Field selection → Column naming → Pattern preview → Correlated data → **Multiple page selection** → Extraction of results

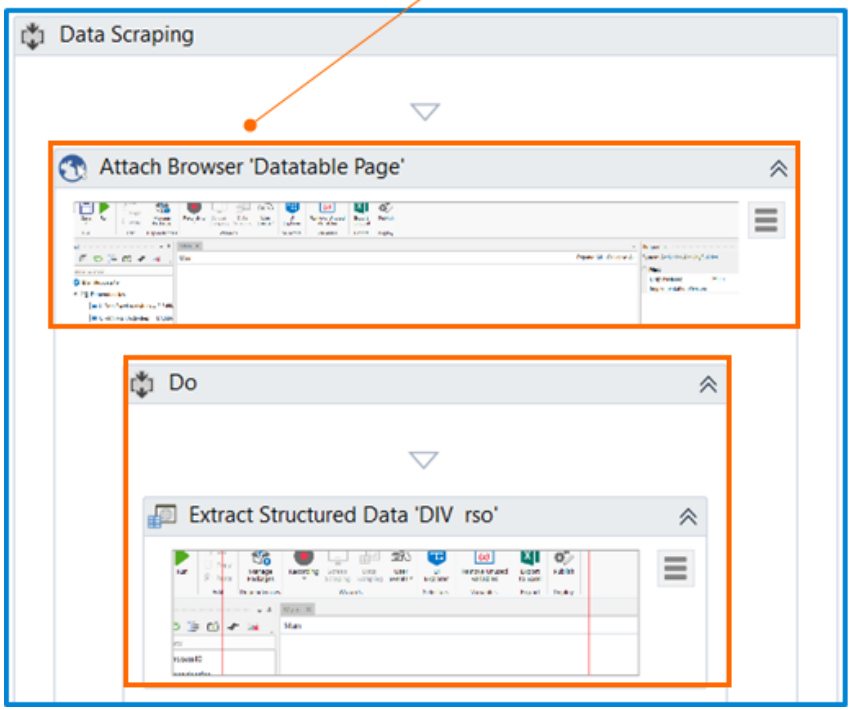


- after the 'Next' button is clicked, the wizard asks whether the **data spans on multiple pages**, and if so, the user needs to point out the **next button** ***(not the number of the next page).***

Extract Wizard. Step 7

Wizard opening | Field selection | Column naming | Pattern preview | Correlated data | Multiple page selection | **Extraction of results**

- the **Designer** will be populated with **a sequence of all the activities**, just like for **Screen Scraping;**
- a **DataTable** variable is initialized with the extracted information.

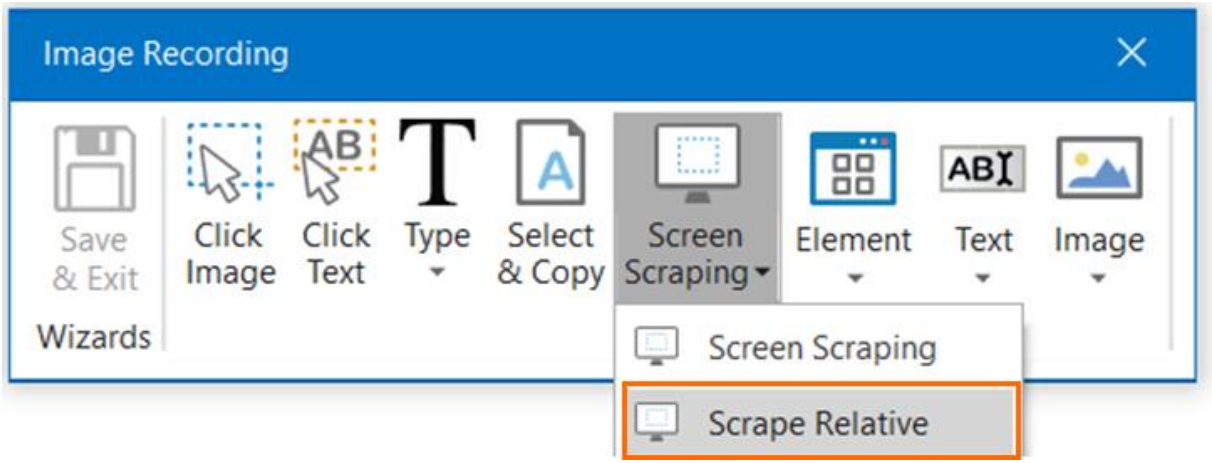


Demo 3. Data Scraping Applied

- **Automate the following process;**
  - ***open*** **the www.cs.ubbcluj.ro web page opened in Chrome browser;**
  - ***save*** **the extract the data available in Announcements section;**
    - ***the Announcements section consists of title, date and content;***
    - ***use*** **Data Scraping Wizard /Extract Wizard** ***to take out data from the web page;***
    - ***specify the maximum number of results;***
  - ***save*** **the extracted data into an Excel workbook;**
    - ***use Write Range activity from Workbook activity package.***

Relative Scraping. Details

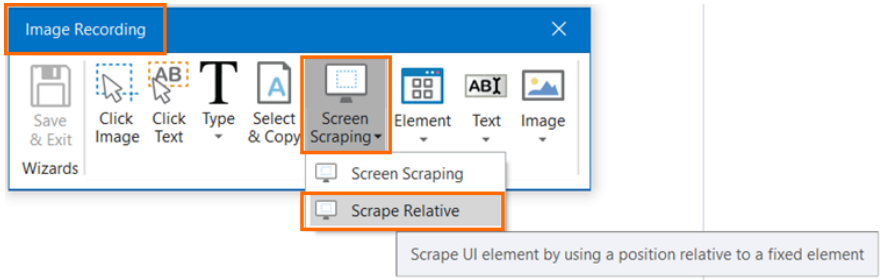
- **Relative Scraping**
  - is a technique that enables retrieving text from special UI elements by
    - **using visual anchors** and
    - the **OCR technology**;
- **When to use it?**
  - in situations where **selectors cannot be found**;
  - when **certain UI elements are difficult to access** by normal means;
  - with applications in **virtual environments** (such as Citrix apps);
- **Screen Relative** option is available under **Image Recording**, in **Screen Scraping** category of activities.

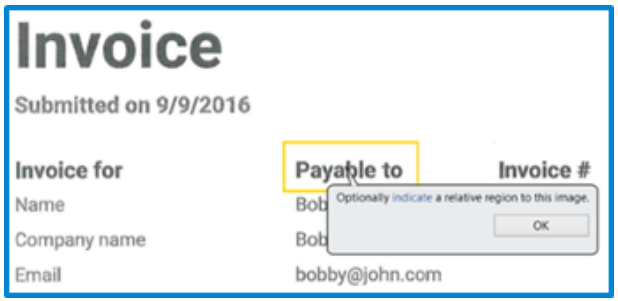


Relative Scraping. Steps

- **Steps to perform relative scraping:**
  - 1. **Start Image Recording**, go to **Screen Scraping** and select **Scrape Relative**.
  - 2. Point the UI element to extract data from. The OCR engine will attempt to identify the text right away.
  - 3. Select a visual area related to the text that will be scraped. The wizard will retain the position of the text relative to the specified anchor.
  - 4. The **Attach Window** container that is generated contains a **Find Image** activity that locates the position of the anchor on the screen.

- after the above operations are being done, the sequence is created in the Designer. The specificity relies on the fact that a **Find Image** activity is placed before the **Get OCR text** activity.





Relative Scraping. Extracting Attributes

- the attributes of a UI element, such as its exact screen position or its ancestor can be extracted;
- there are 3 different UiPath activities available;

Get Ancestor: Retrieves an ancestor for a specified UI element.

- **Input:** UpLevel: specifies at which level of the UI hierarchy to find the ancestor.
- Output: Ancestor as a UI Element variable.

Get Attribute: Retrieves the value of a specified attribute of a UI element.

- **Input:** the name of the Attribute as string.
- **Output:** the value of the specified Attribute.

Get Position: Retrieves the bounding rectangle of a specified UI element.

- **Output:** the resulting bounding Rectangle variable for the specified UI element in screen coordinates.

Intelligent OCR in UiPath

- This pack is built around the **ABBYY FlexiCapture** technology, that enables complex OCR activities, such as:
  - **Document classification;**
  - **Structured data extraction;**
  - **Table extraction;**
  - **Document exporting;**
  - **Document digitalization.**

Custom Activities. Details

- **Custom activities** development provides:
  - improved clarity of the workflow;
  - increased reusability for similar processes/steps of processes;;

- there are several ways to develop custom activities:
  - Creating and publishing a UiPath library `.nupkg` file;
  - Create a C# `.dll` and building a `.nupkg` file imported in UiPath;

- **Demo:**
  - Create a package consisting of an activity that allows to insert an item in a collection;
    - this is similar to the use of **Invoke Method** activity with the benefit of not requiring signature knowledge on the `Insert` method.

References

- UiPath Academy - https://academy.uipath.com
  - Level 1 – Foundation Training, Lesson 5;
- UiPath Docs - https://docs.uipath.com/studio
  - UI Elements - https://docs.uipath.com/studio/v2018.3/docs/about-ui-elements