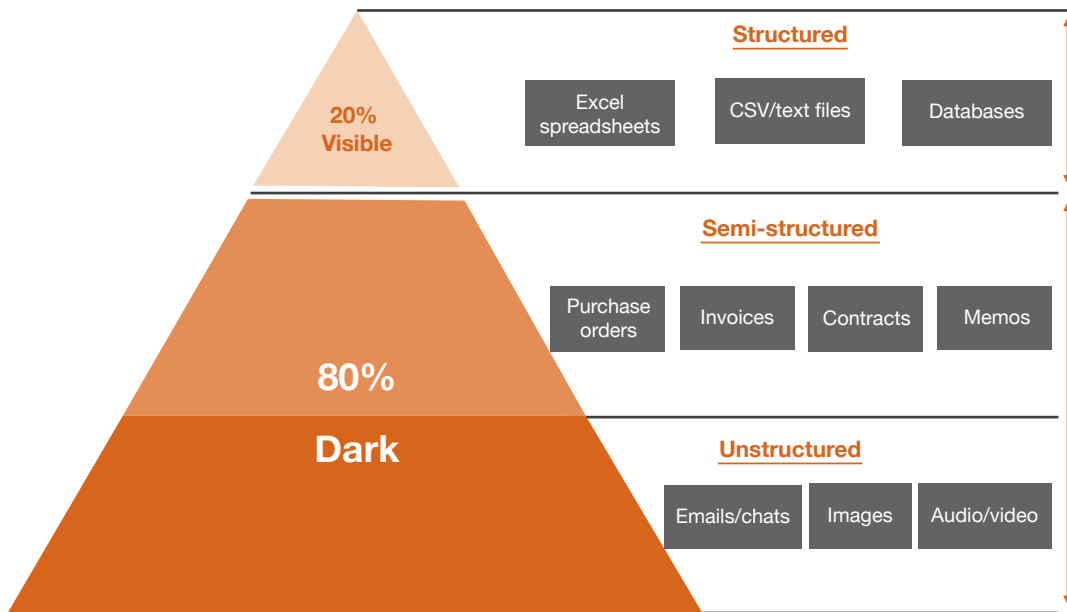# IQ Bot:
A practitioner's perspective

pwc

Slowly and steadily, automation has started becoming ubiquitous. While an automated task bot can manage most repetitive tasks involving structured data, it is unable to handle a vast amount of semi-structured or unstructured data (or 'dark data').

Dark data, which constitutes 80% of any business process, is posing a huge challenge to organisations. Processing dark data requires humans to locate the hidden data and create a structured format which can then be processed by task bots.

What is dark data?[1]

Structured

| 20% Visible | Excel spreadsheets | CSV/text files | Databases |

Semi-structured

| Purchase orders | Invoices | Contracts | Memos |

80%

Dark

Unstructured

| Emails/chats | Images | Audio/video |

This issue attracted the attention of various product companies working on automation and thus began a quest to develop a technology that could understand dark data and enable its smooth conversion into a compatible format for bots.

Today, multiple robotic process automation (RPA++) or intelligent process automation (IPA) solutions are available. **Intelligent** optical character recognition **(OCR)** is one such solution that is fast catching on in the IPA space, helping organisations to create a *straight-through automation solution* for processes with a high percentage of dark data.

1.   Rai, M. (9 November 2017). Can cognitive RPA help you emerge from the age of dark data? Automation Anywhere. Retrieved from https://www.automationanywhere.com/in/blog/changing-the-world-with-automation/can-cognitive-rpa-help-you-emerge-from-the-age-of-dark-data

Breaking down intelligent OCR

In our previous thought paper, 'Robotic process automation and intelligent character recognition',[2] we discussed Intelligent OCR and its application in simplifying paper-driven processes where inputs are received as PDF files, scanned, faxed and handwritten documents. The accuracy of intelligent OCR in the conversion of input documents having different layouts with varied resolutions and quality is unparalleled.

However, the current RPA technology cannot address all the challenges in OCR automation. This is where **IQ Bot** comes in. With techniques such as continuous validation and AI, it enables an organisation to automate human-centric processes involving fields and patterns. IQ Bot is more accurate due to the learning from humans through the feedback loop; it is also faster and virtually foolproof. At the same time, it reduces human processing costs.

IQ Bot 5.3.1 aims to deliver automation using the cognitive technology that reads and processes dark data while improving its skills and performance by learning from people at work.
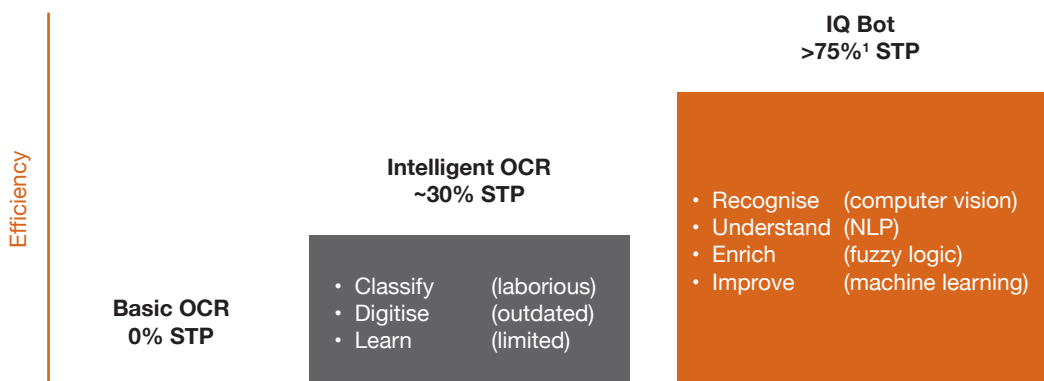
Understanding IQ Bot

IQ Bot enables business users to create software robots with limited help from programmers. These robots can read and extract information from documents using AI and machine learning technologies. While RPA is rule based and always requires human intervention for processing dark data, the combination of cognitive abilities with RPA enables end-to-end process automation.

Moreover, IQ Bot complements all RPA-based solutions to achieve end-to-end straight-through processing (STP[3]) for processes involving dark data. OCR is just one of the components of IQ Bot. It augments this technology by identifying variations in layout and content and helps in improving the extraction of fields by mapping them to the right variables. IQ Bot performs better than intelligent OCR as it can locate data, extract it, as well as learn which types of data to extract based on human corrections. To enable IQ Bot to perform these functions, proprietary IP algorithms are designed which run on a standard open source OCR.

IQ Bot vs intelligent OCR[4]

Efficiency (vertical axis)

IQ Bot
>75%[1] STP
- Recognise (computer vision)
- Understand (NLP)
- Enrich (fuzzy logic)
- Improve (machine learning)

Intelligent OCR
~30% STP
- Classify (laborious)
- Digitise (outdated)
- Learn (limited)

Basic OCR
0% STP

[1]Based on collated, averaged data from customer implementations

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2. PwC. (July 2018). RPA and intelligent optical character recognition. Retrieved from https://www.pwc.in/assets/pdfs/technology/financial-services-technology/intelligent-process-automation-ocr-whitepaper.pdf
3. STP is the percentage of processes that can be fully automated without human intervention.
4. Source: Automation Anywhere IQ Bot Product Team

So, how does IQ Bot increase the STP ability through RPA automation?

Based on our experience with a couple of large RPA implementations, we have picked invoice-based processes that are typically document heavy and entail multiple formats. We took a sample of 100 invoices in 30 different formats, including scanned images and PDF files with unstructured data. One team tried to automate the process using PDF integration and OCR, while the other team used with IQ Bot to extract the data for processing in SAP.

1) RPA without IQ Bot

In this case, documents were classified manually and then OCR was applied to extract data. Even after this manual classification, only 40% accuracy and 45% STP were achieved. The extracted data then had to be verified and approved manually by senior knowledge workers. Moreover, this process was time-consuming and there were limitations with respect to certain invoice formats and data spanning multiple pages.
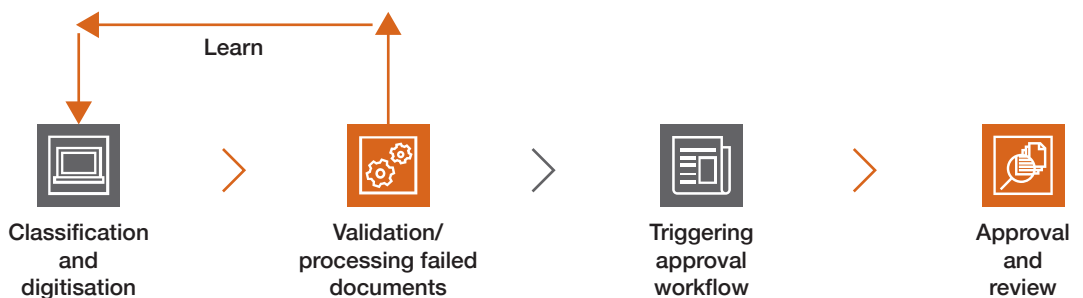
Business process without using IQ Bot[5]

Classification of documents	Attempting OCR	Validating/ processing failed documents	Validating the documents manually	Triggering approval	Final review and approval

2) RPA + cognitive IQ Bot

In this scenario, IQ Bot learned from humans through a feedback loop. Thus, the efficiency and processing time of the process was improved, resulting in 75% accuracy and 80% STP.

Business process using IQ Bot[6]

Learn

Classification and digitisation	Validation/ processing failed documents	Triggering approval workflow	Approval and review

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5.   Source: IQ Bot 5.3.1 User Guide and release notes
6.   Ibid.

Understanding the inner functioning of IQ Bot:

1. **Learning instance creation:** In the first step, the information that has to be extracted from the documents needs to be specified. Key information can be specified to help the extraction process—for example, document type, language and fields. The required documents are uploaded to get an in-depth analysis report.

2. **Document analysis:** In this step, the bot identifies:

    a. Similar documents and groups them

    b. Groups that are more likely to return all the required fields

    c. Groups that should be trained to ensure maximum veracity

3. **Bot training:** At this stage, the user is able to review and adjust the automatic field name and value mappings that the cognitive system suggests. One document is selected per group and the bot is trained by mapping the required field and setting up validation rules. The selected document must capture the traits of the maximum number of documents in the group. Moreover, this bot, when sent to production, will process all the documents identified as part of this group.

4. **Validation:** At this stage, all the unprocessed documents become available for human validation. Users need to go through the validation errors and correct them. The IQ Bot simultaneously learns by observing human behaviour and is trained continuously.

5. **Progress monitoring:** The IQ Bot dashboard helps in monitoring the progress of the learning instances in production.

Functioning of IQ Bot[7]
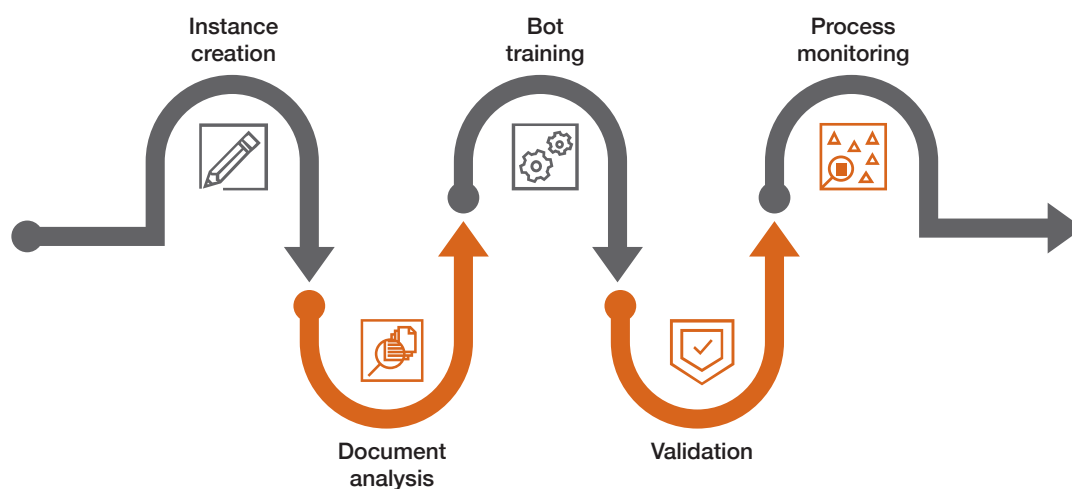
Note: Integration of IQ Bot into the rest of the workflow (task bot and meta bot) is possible. Further, custom validation can be performed on the data extracted by IQ bot.

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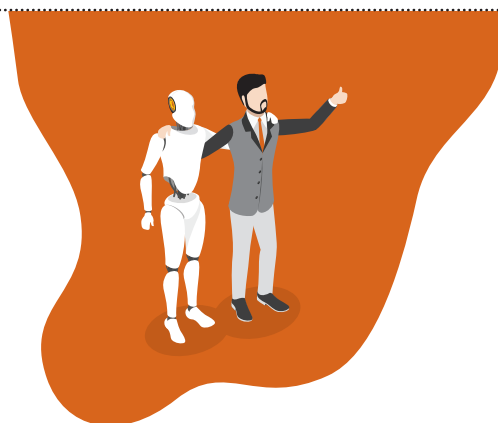
7.   Source: IQ Bot 5.3.1 user guide and release notes

The enhancements made to recent versions of IQ Bot are shown below:

IQ Bot – version enhancements[8]

Version 5.0.0

- Flags exceptions based on confidence level
- Captures human expertise
- Semantic analysis
- Supports documents like invoices, purchase order and bills
- Auto-filtering by data type
- Undertakes work shadowing of the business resource
- Arithmetic, logical and date functions
- Field collision resolution
- Cross-field mapping
- Multi-language support, including English, Spanish, French, German and Italian

Version 5.1

- Accuracy and STP increase
- Performance improvement – 5% increase in accuracy and STP raised by up to 10%
- UI changes – improved notifications, buttons, simplified yet elegant login screen
- Pagination – improved interaction with classified group
- Unused learning instances can now be deleted
- Access to unclassified and unprocessed files

Version 5.2

- STP improvements
- Import/export tool – learning instance can now be imported/exported between versions, thus eliminating the need to replicate training across machines
- Character-level confidence threshold
- Supervised learning in validation
- Improved table extraction
- Password encryption
- Support for IE and Edge browser
- Automatic reclassification of unclassified PDF
- Automatic field mapping during bot creation – bots are now pre-trained using intelligence for determined domains. Field labels, values and header are automatically mapped based on the results of the classification process. Users are now only required to confirm/modify the fields that are mapped incorrectly.

Version 5.3

- Multi-language support – more than 25 languages are supported
- Additional table/section extraction – allows extraction of repeated tables and sections
- BOT store domain – document processing domain can now be downloaded from Bot Store and imported to IQ Bot
- Additional field for extraction – additional fields/tabular columns can now be added while editing a learning instance
- Advanced migration utility
- Trained larger sized files – increased from 5 MB to 12 MB
- Task Bot compatible UTF-7 CSV output
- Compliant logging

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8.   Source: IQ Bot 5.3.1 user guide and release notes
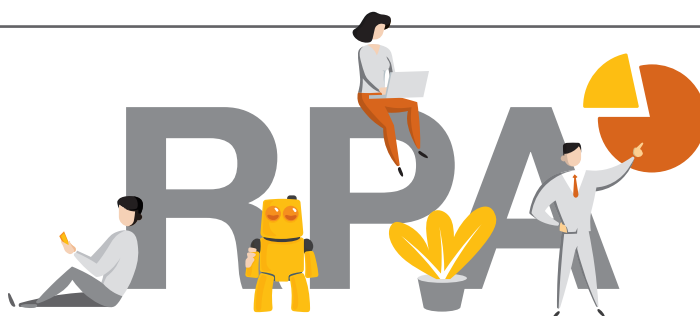
Let's look at a recent client engagement where IQ Bot was used:

Client

One of the world's largest steel manufacturing companies

Business driver

The inputs for the processes that had to be automated consisted of documents containing various formats, including invoices and purchase orders. The process of sundry payments alone involved invoices in 400+ formats (.pdf, .tiff and scanned images). This made the conversion process extremely complex, and as a result, the company struggled to meet its yearly service-level agreements (SLAs) and targets, leading to staggered profits. In order to solve this problem, a solution that integrated OCR and PDF was initially recommended, but with variety of formats increasing every quarter, this proposition could not be sustained.

Solution

As a solution to the constantly changing and increasing number of formats, IQ Bot 5.3.1 was suggested as part of the process. After this enhancement, there was a 70% increase in accuracy and the quality of data extracted improved by 65%. The previous process, which needed a lot of manual intervention, could now be automated end-to-end. Thus, IQ Bot increased efficiency, accuracy, data quality and saved a lot of time, thus enabling the organisation to meet their targets and SLAs.

Moreover, following successfully deployment of IQ Bot, other processes have been taken up for automation.

In our journey towards realising the maximum potential of process automation, by using IQ Bot, we could automate most of the processes end to end with improved data quality and minimum time and effort. The benefits of IQ Bot are summarised below:

1. A dashboard that provides a bird's-eye view of the progress across all processes

2. Recognition and categorisation of different document types and formats

3. The ability to learn with every validation and facilitate continuous improvement

4. Prevention of changes in existing workflows

5. Sharing of domain configuration by bots to save time during the design process

6. Usage of computer vision and machine learning to detect patterns and classify documents into groups in order to reduce training redundancies

7. Presence of an indicator that signals the accuracy and reliability of the bot

A few opportunity areas that can be explored in the upcoming versions for better user and developer experience:

1. IQ Bot 5.3.1 (being the latest at that time) did not work with Enterprise RPA 11.x. While we could still get the job done with a lower version, compatibility with the new version would further enhance the user experience.

2. There are very few predefined templates and we are afraid that a lot of standard process templates in the industry might have been missed out. We would be happy to see those implemented in the upcoming versions of IQ Bot.

3. The current version didn't support the splitting of documents automatically and the same had to be split manually in order to be processed. Although this could be done using task bot workarounds which are little complex, we await a few enhancements in this area as well.

4. During the creation of learning instances, the required fields need to be defined as a first step, and cannot be edited or deleted later. A new feature can be introduced in future versions to edit the fields in order to improve the developer experience.

5. The dashboard displays cumulative information about the number of files processed, percentage of STP and accuracy, etc. However, another component that provides the actual number of files processed in a particular run will make the user experience more comprehensive and effortless.

6. On successfully completing the processing of scenarios where the task bot calls IQ Bot and waits before running the next set of tasks, a notification or specific handle confirming this would be helpful.

IQ Bot marks a leap forward in terms of innovation. However, as is the case with most technologies, there are certain limitations that need to be addressed.

We end by outlining some of the features of IQ Bot 6.5[9] released recently:

1) Compatible with 11.x version

2) Toggle between OCR engines: Users can toggle between Tesseract4 or ABBYY FineReader Engine v12.2 as IQ Bot's OCR engine while leveraging IQ Bot's native document classification, auto correction and extraction capabilities.

3) Extended international language support: 190 languages, including but not limited to Asian languages such as Japanese, Korean, Chinese (Simplified) and Chinese (Traditional)

4) Internationalisation and localisation: Users can select the language from a drop-down list at the time of instance creation.

5) Database encryption: IQ Bot document data stored in database tables and columns is encrypted to protect potentially sensitive information. As yet, this does not apply to field value data humans manually correct in the IQ Bot validation queue.

6) Audit logs for IQ Bot: The administrator can see action logs for all IQ Bot users in the audit logs tab of the Enterprise Control Room. Successful and unsuccessful actions are logged along with reasons for failure logs.

7) Windows authentication: The IQ Bot platform administrator can enable Windows authentication during IQ Bot platform installation, to connect SQL databases with Windows or dual authentication.

8) Custom role-based access to IQ Bot instances through Enterprise Control Room.

9) Microsoft Azure SQL database service Platform as a Service (PAAS):

The IQ Bot platform administrator can enable Microsoft Azure SQL Database service during IQ Bot platform installation.

As we gear up for an era where automation will no longer be confined to developers and intelligent bots will continue to be upgraded with more features, solutions like IQ Bot can play a major role in transforming the face of intelligent technology and making it faster, more reliable and user friendly.

Our previous reports

As the cognitive automation technology continuum is changing rapidly and technology innovation and disruption become imperatives, we aim to bring you the latest developments through research a series of white papers on IPA:

Issue 1 – RPA in a virtual environment (May 2018)

Issue 2 – RPA and intelligent optical character recognition (July 2018)

Issue 3 – IQ Bot: A practitioner's perspective

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9. Source: IQ Bot 6.5 user guide and release notes

About PwC's Intelligent Automation (IA) practice

PwC India's IA practice assists clients in their intelligent process automation journey from strategy through execution. With their extensive experience, our professionals support a transformation approach to automation, including continuous improvement and innovation to create a cutting-edge 'IPA value proposition'. Our practice has diverse service offerings covering strategy, governance set-up, automation feasibility and tool selection, centre of excellence set-up, implementation and deployment, bot-managed services, functional and technical training, and risk assessment.

The practice has a wide range of domain professionals and technical consultants with wide experience with global clients and in multiple industries/domain. The team has delivered 100+ projects across industries and has automated 1,000+ processes, creating 1,500+ FTE capacity. It has also deployed 2,000+ active bots in production. Further, our team has strategic partnerships with top-tier market-leading RPA vendors and has considerable experience in integrating RPA bots with niche FinTech solutions, OCR implementation and conversational bots.

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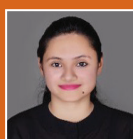
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