Improving Accuracy & Efficiency in Document Handling for Business Processes

Introduction to Research in Computer Science
CPSC-59700

Alison Major • 24-August-2021

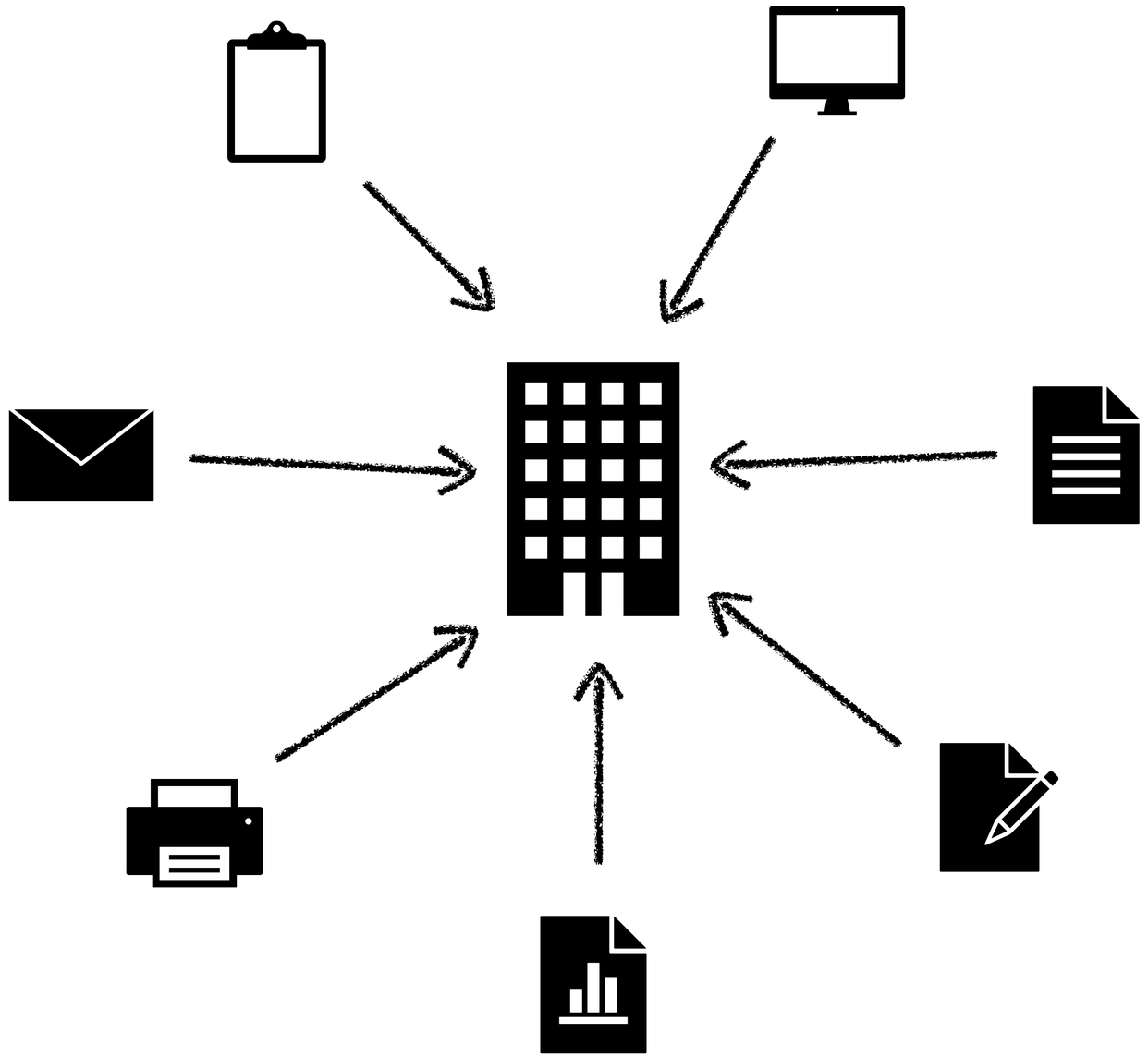
Data comes in many formats .

Manual data extraction is cumbersome and error-prone.

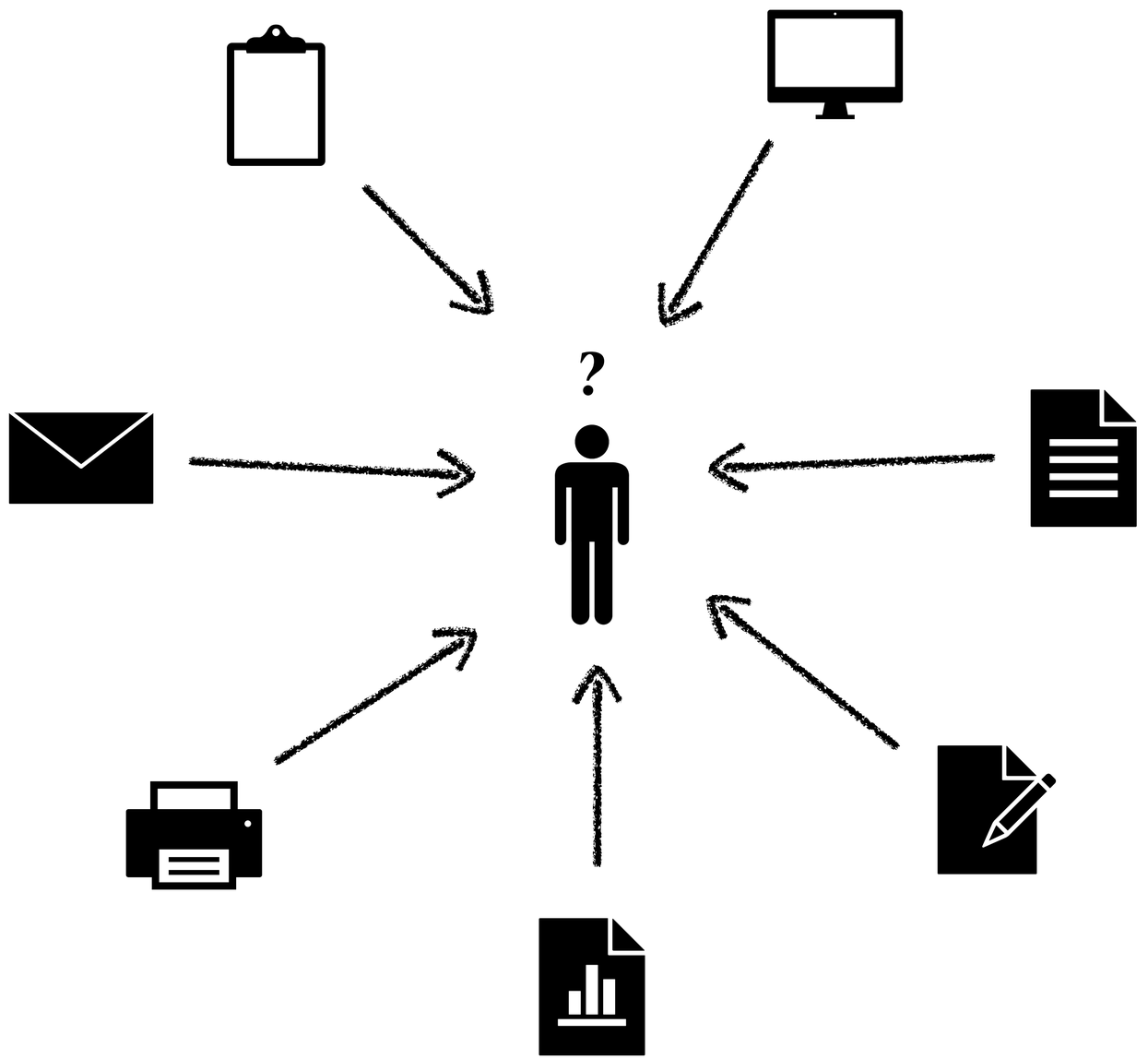
Many tools exist to assist in extracting data,
including OCR, ML, and NLP.

Is there a single method to receive multiple forms of information and automatically pull the desired data?

[Introduction]



[Introduction]



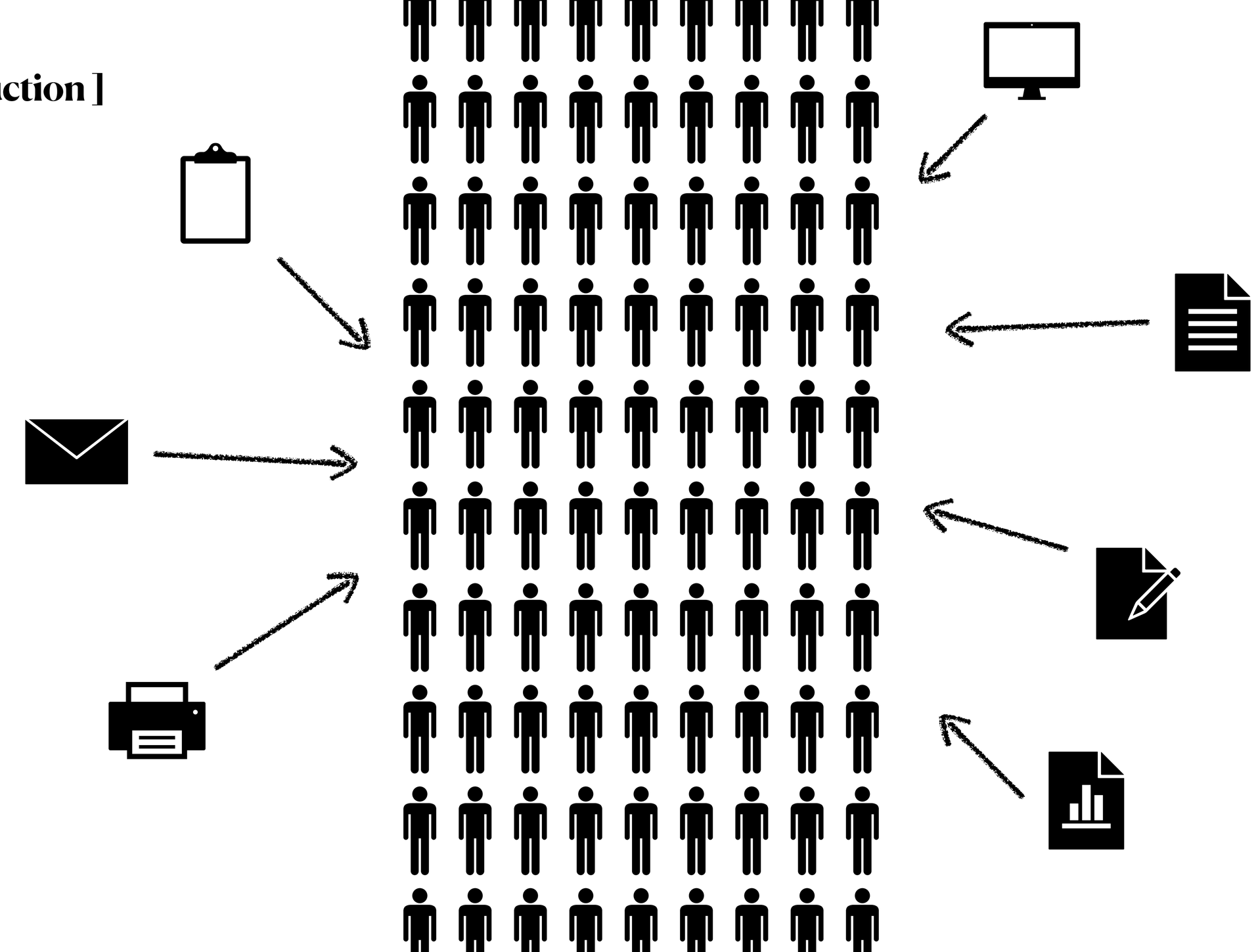
215 students
30 datasheets
6 data types

Average 10.23 errors

Study from 2009 at UNLV.

Matt Harris. When good info goes bad: The real cost of human data errors, 2014. [Online; accessed 15-August2021].

[Introduction]



[Manual Data Entry]

Direct and indirect cost of manual data entry for global businesses were estimated to be about $2.7 trillion.

2018, Goldman Sachs

James Schneider Ph.D., Bill Schultz, Julia McCrimlisk, Jesse Hulsing, and Ryan M. Nash CFA. B2B: How the next payments frontier will unleash small business. EQUITY RESEARCH, 2018. [Online; accessed 13-August2021].

[Manual Data Entry]

Avoidable Rework for accounting staff of 40: $878,000 per year

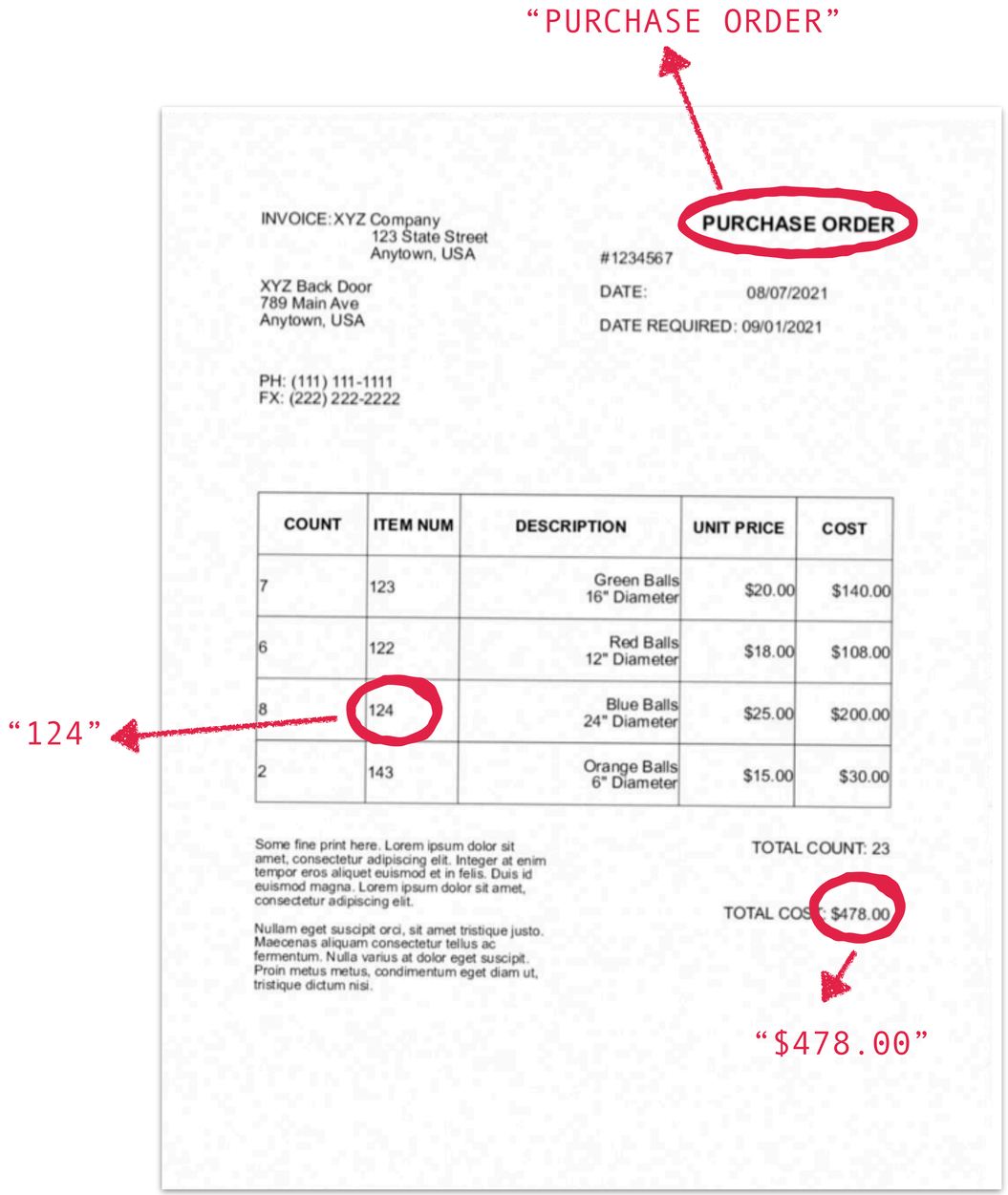
2019, Gartner

Justin Lavelle. Gartner says robotic process automation can save finance departments 25,000 hours of avoidable work annually, 2019. [Online; accessed 13-August2021].

How can we make data extraction simpler?

Optical Character Recognition

- Technique that converts images and files into machine-readable data
- Challenges:
  - Orientation & skew
  - Noise or distortion
  - Handwriting or stamps covering printed text



INVOICE: XYZ Company
123 State Street
Anytown, USA

#1234567

DATE: 08/07/2021

DATE REQUIRED: 09/01/2021

XYZ Back Door
789 Main Ave
Anytown, USA

PH: (111) 111-1111
FX: (222) 222-2222

COUNT	ITEM NUM	DESCRIPTION	UNIT PRICE	COST
7	123	Green Balls 16" Diameter	$20.00	$140.00
6	122	Red Balls 12" Diameter	$18.00	$108.00
8	124	Blue Balls 24" Diameter	$25.00	$200.00
2	143	Orange Balls 6" Diameter	$15.00	$30.00

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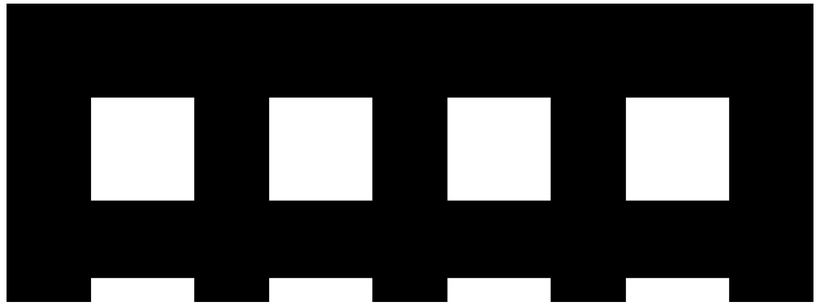
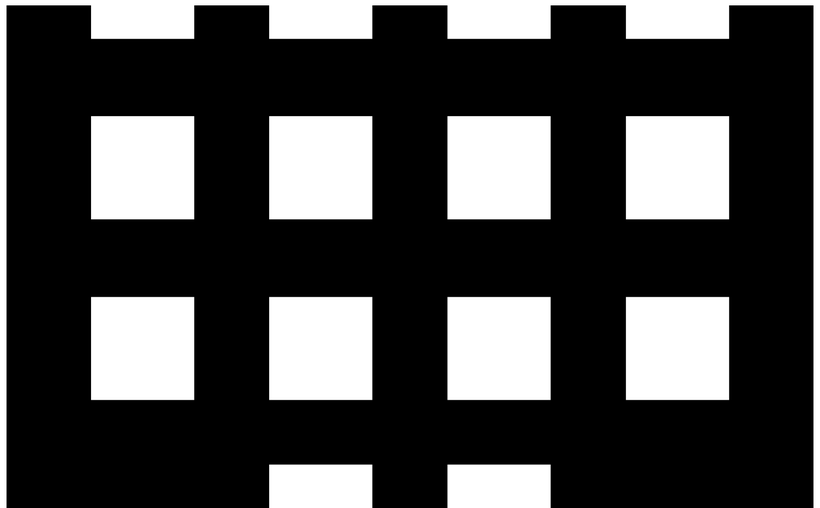
TOTAL COUNT: 23

TOTAL COST: $478.00

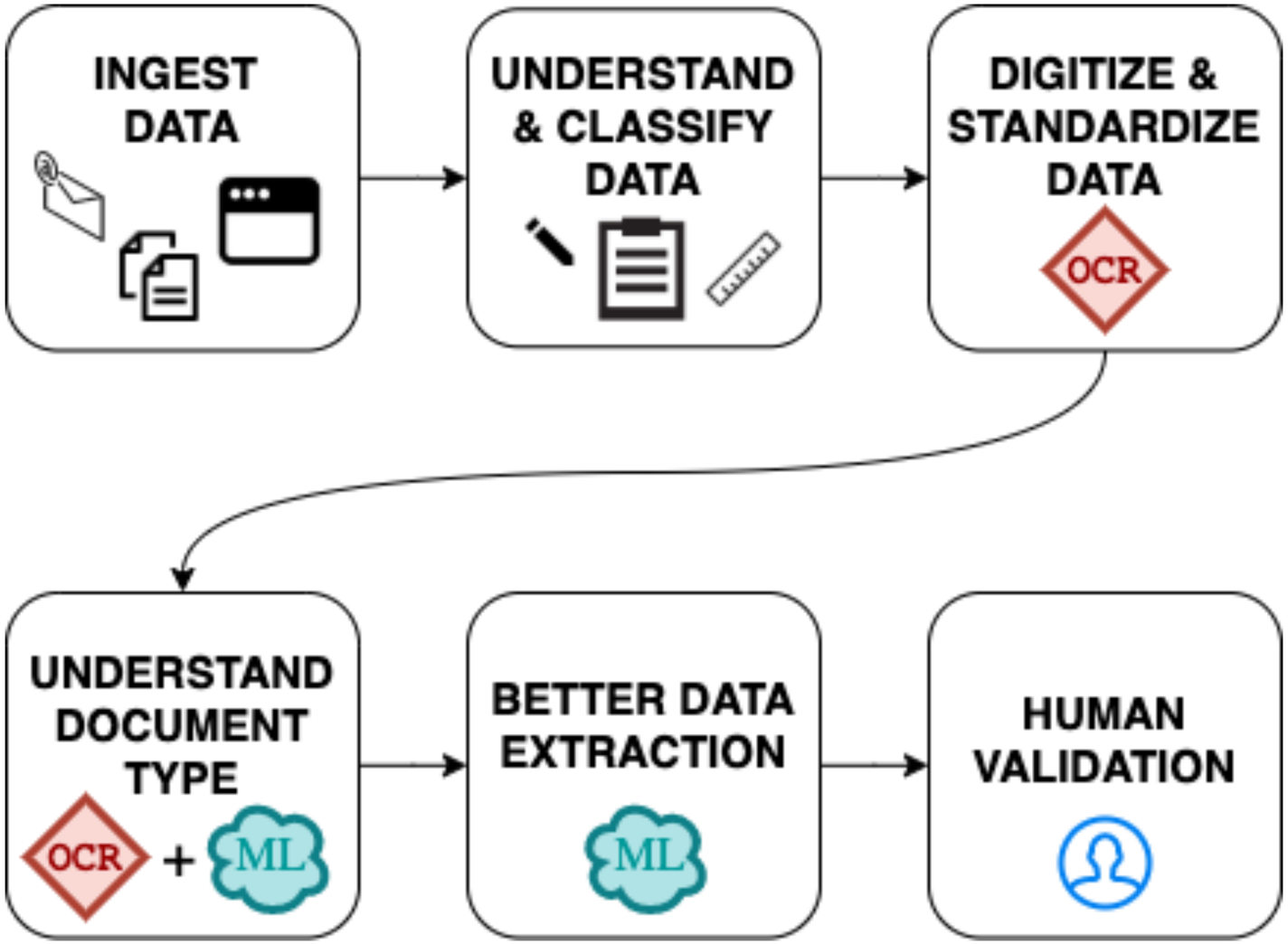
?



How does a business process data?



[Processing Data]



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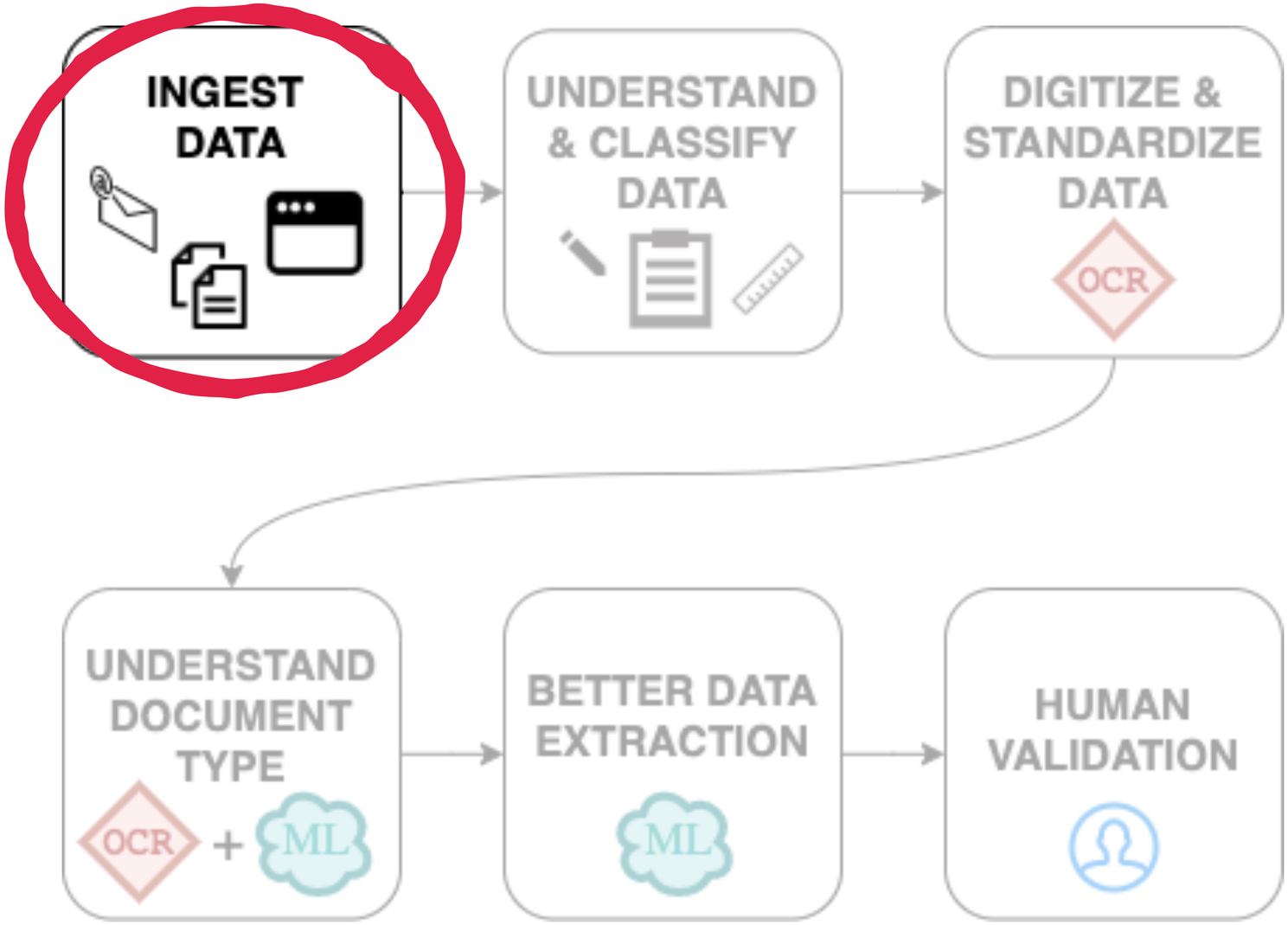

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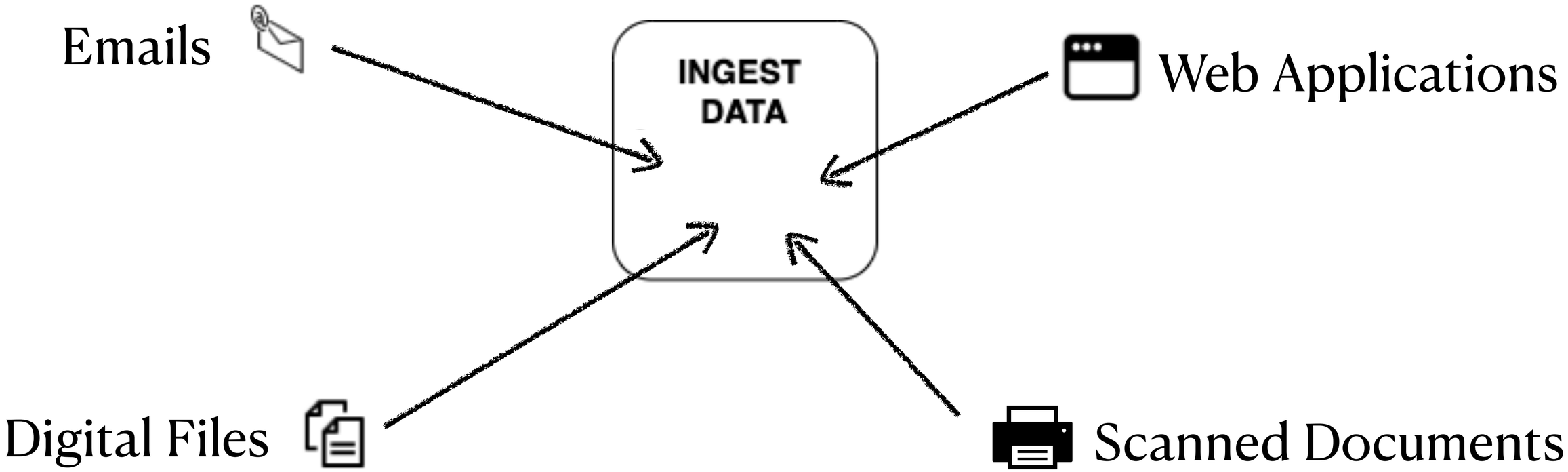

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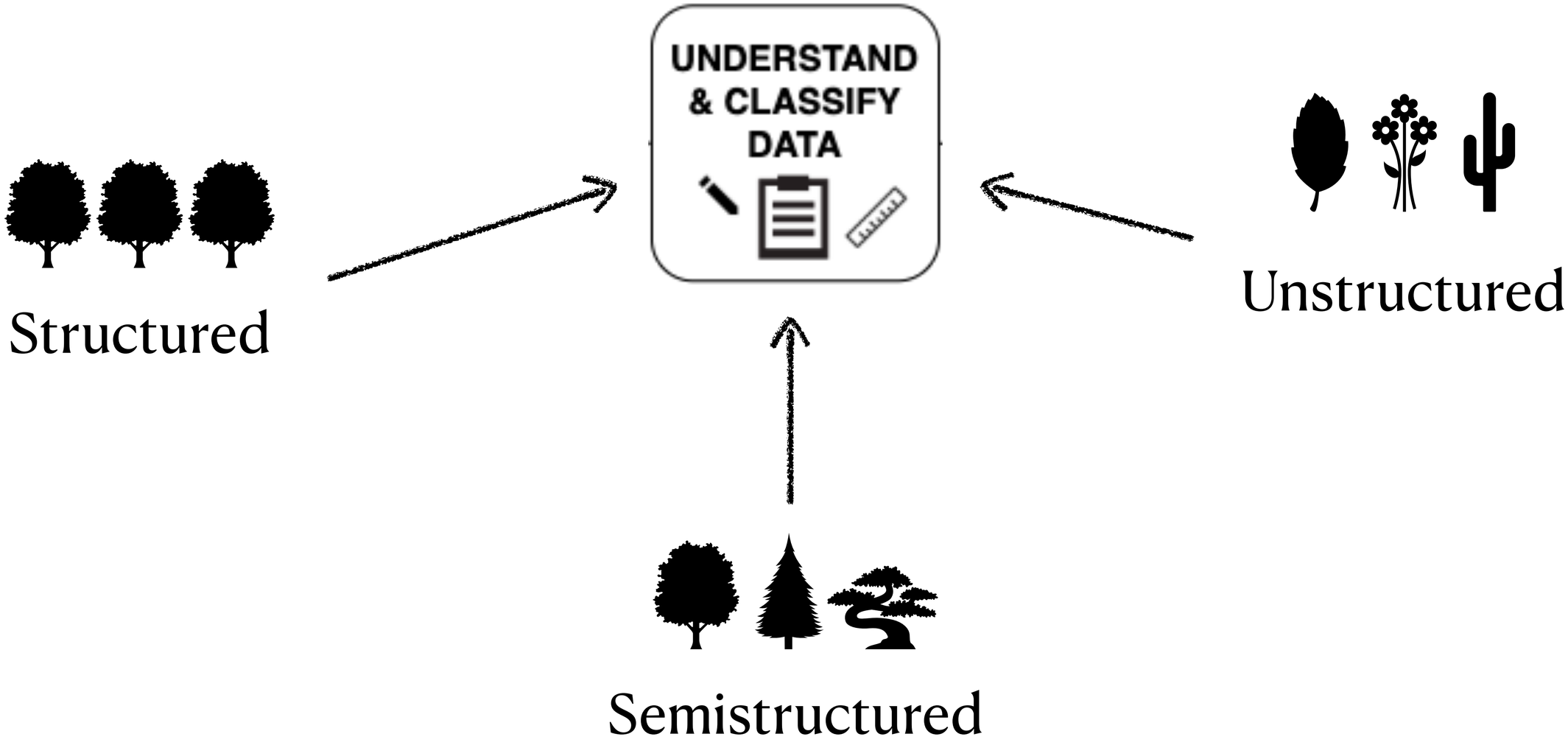

[Processing Data]

Structured

- Formatted in a consistent template
- Tables with values in predictable positions
- Same layout for every document

Layout 1

INVOICE TO: XYZ Company
123 State Street
Anytown, USA

SHIP TO LOCATION:
XYZ Back Door
789 Main Ave
Anytown, USA

PHONE: (111) 111-1111
FAX: (222) 222-2222

PURCHASE ORDER

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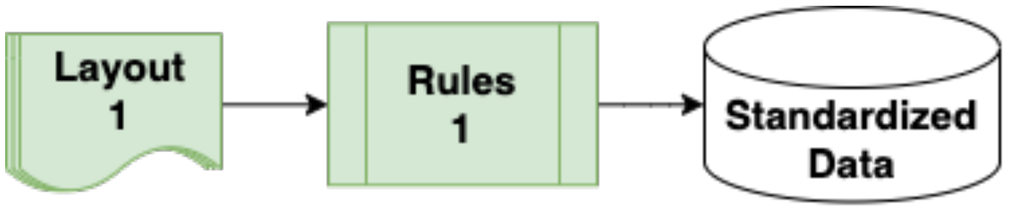
TOTAL QTY.
23

TOTAL COST
$478.00

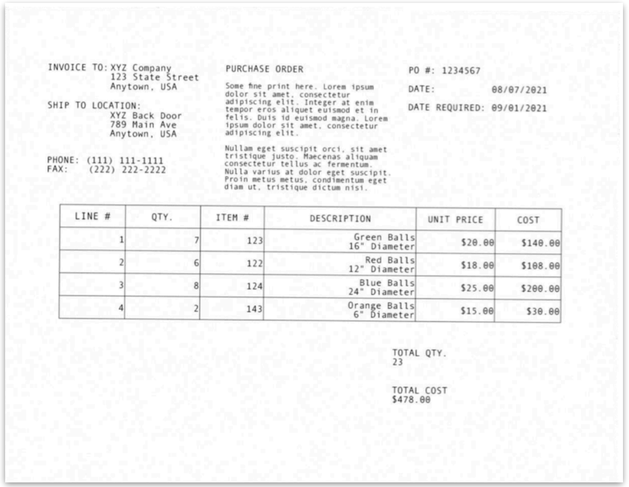


[Processing Data]

Semistructured

- Same key-value pairs
- Different layouts for the information
- Positions of values vary
- Using the same rules for a different layout results in low accuracy for the “wrong” layout

Layout 1



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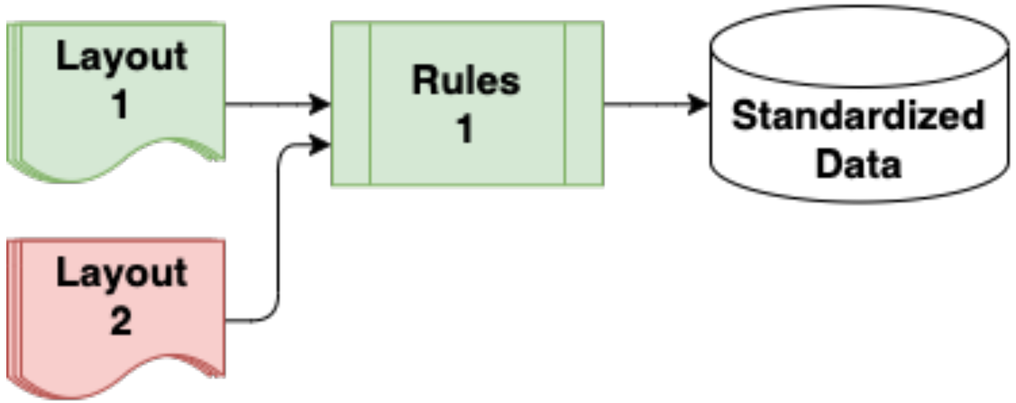
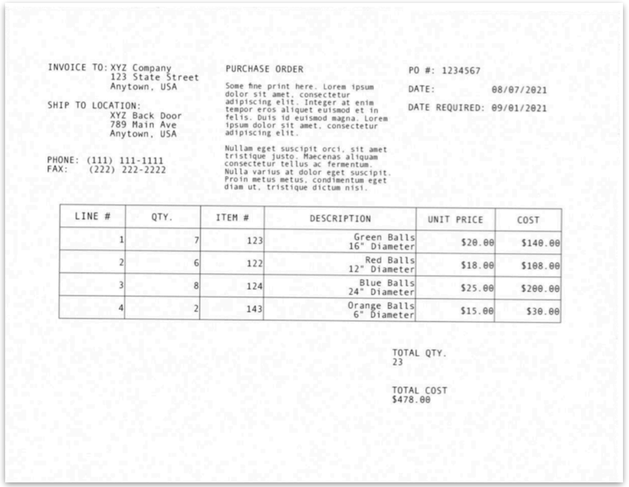


[Processing Data]

Semistructured

- Create rules for each layout
- Scaling...
  requires template
  and rules management!

Layout 1



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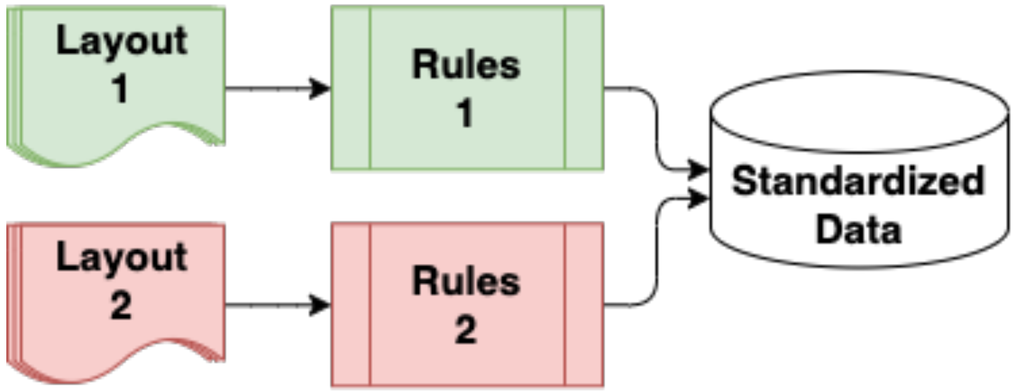

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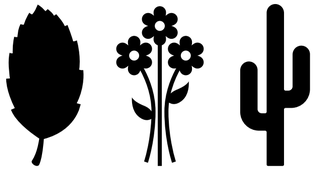
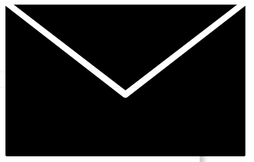


Unstructured

- No key-value pairs
- Free-flowing
- Lacks consistency
- May contain handwriting
- Consider NLP for extraction



Hello again!

I'd like to order more of the following:

7 cases of 16" Green Balls

6 cases of 12" Red Balls

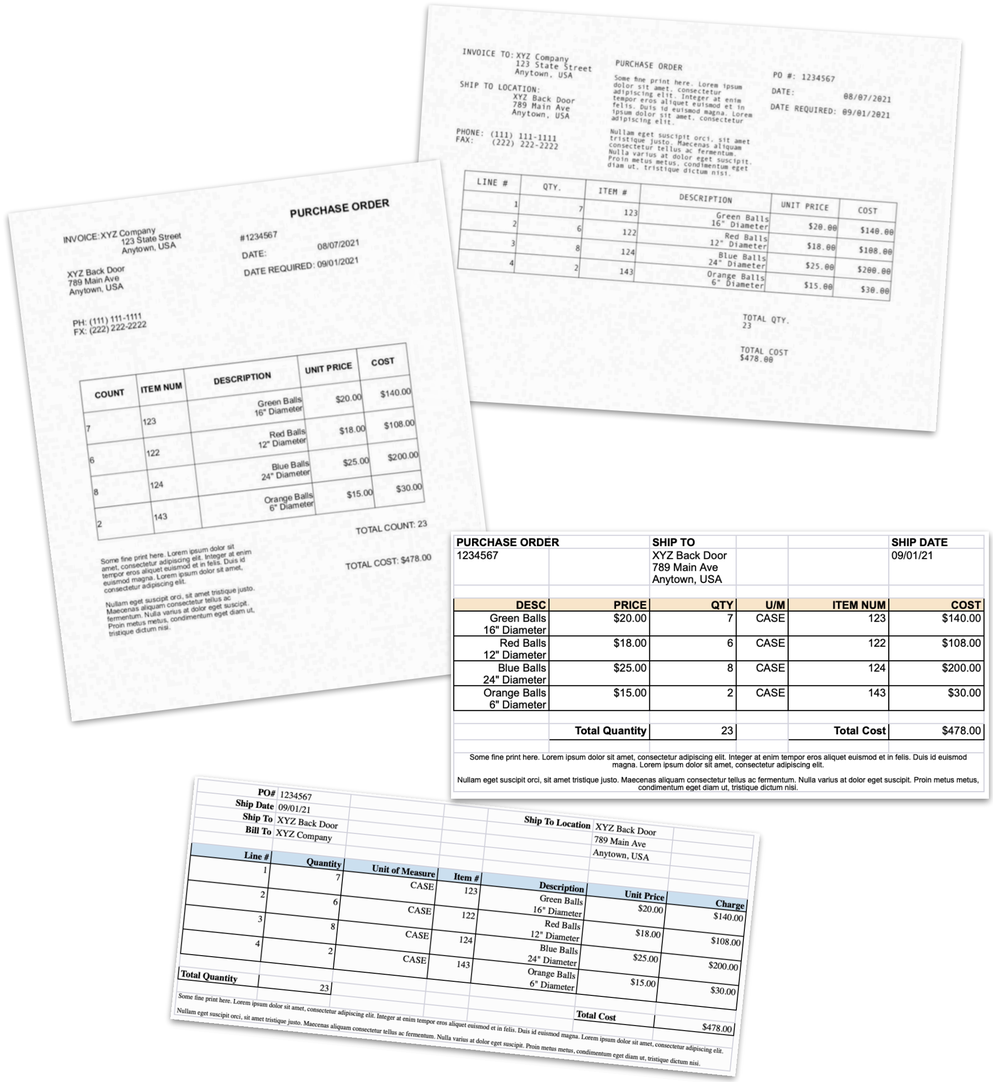
8 cases of 24" Blue Balls

2 cases of 6" Orange Balls

I need them by September 1.

Thanks!

[Processing Data]



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PURCHASE ORDER

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PURCHASE ORDER					SHIP TO					SHIP DATE
1234567					XYZ Back Door 789 Main Ave Anytown, USA					09/01/21
DESC		**PRICE**	**QTY**	**U/M**				**ITEM NUM**		**COST**
Green Balls 16" Diameter		$20.00	7	CASE				123		$140.00
Red Balls 12" Diameter		$18.00	6	CASE				122		$108.00
Blue Balls 24" Diameter		$25.00	8	CASE				124		$200.00
Orange Balls 6" Diameter		$15.00	2	CASE				143		$30.00
	Total Quantity		23					**Total Cost**		$478.00

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PO#	1234567				Ship To Location	XYZ Back Door 789 Main Ave Anytown, USA	
Ship Date	09/01/21						
Ship To	XYZ Back Door						
Bill To	XYZ Company						
Line #	**Quantity**	**Unit of Measure**	**Item #**	**Description**	**Unit Price**	**Charge**	
1	7	CASE	123	Green Balls 16" Diameter	$20.00	$140.00	
2	6	CASE	122	Red Balls 12" Diameter	$18.00	$108.00	
3	8	CASE	124	Blue Balls 24" Diameter	$25.00	$200.00	
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Total Quantity	23				**Total Cost**	$478.00	

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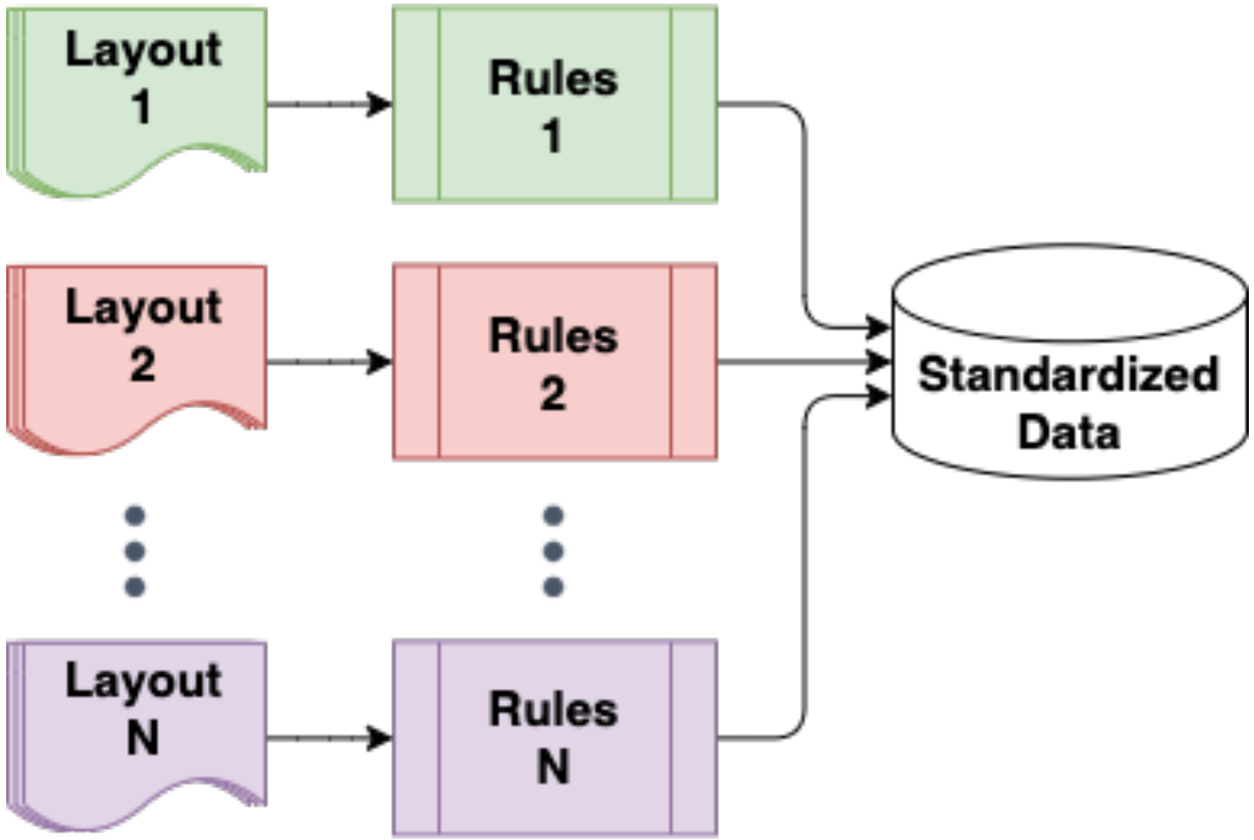

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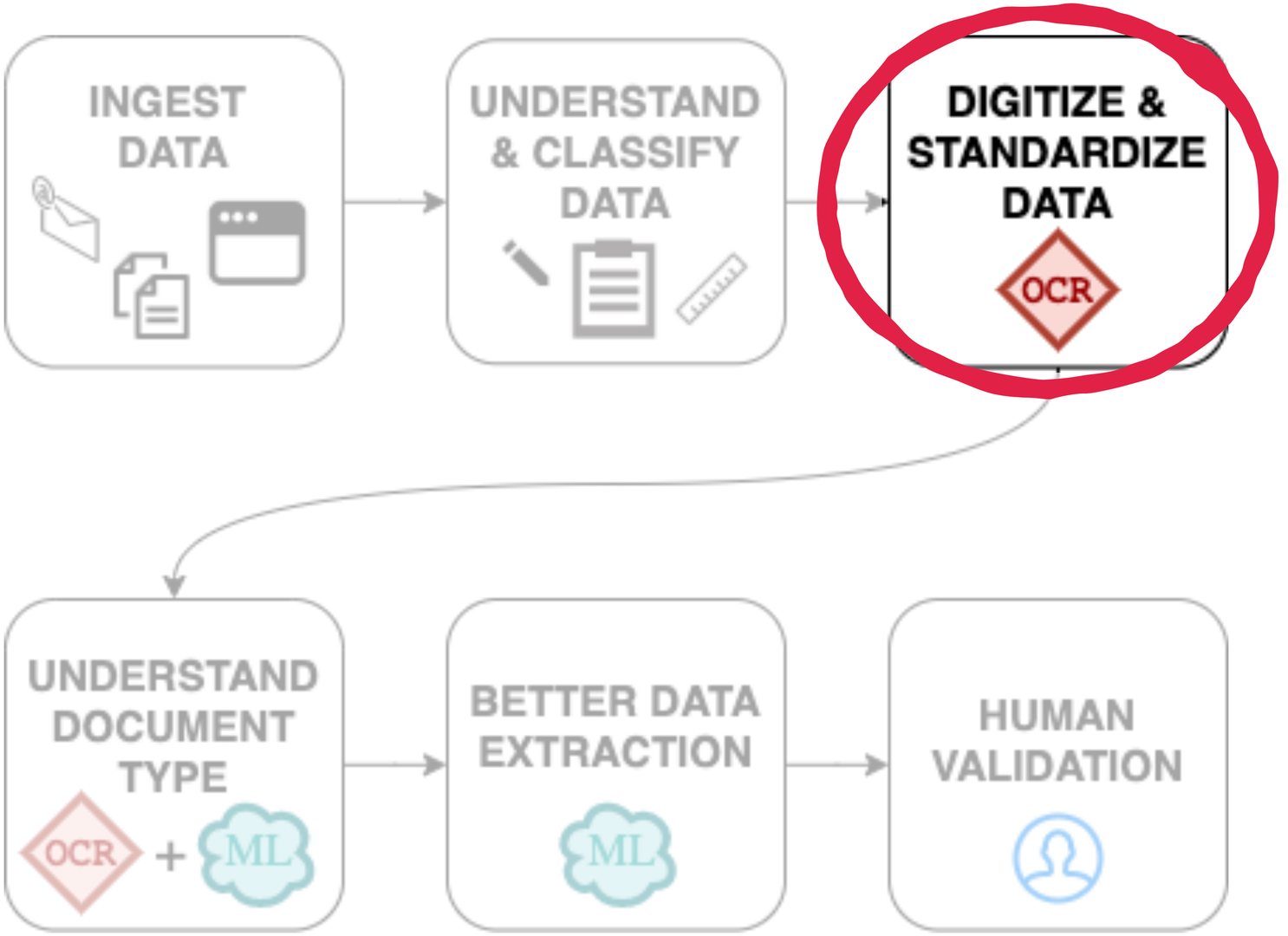
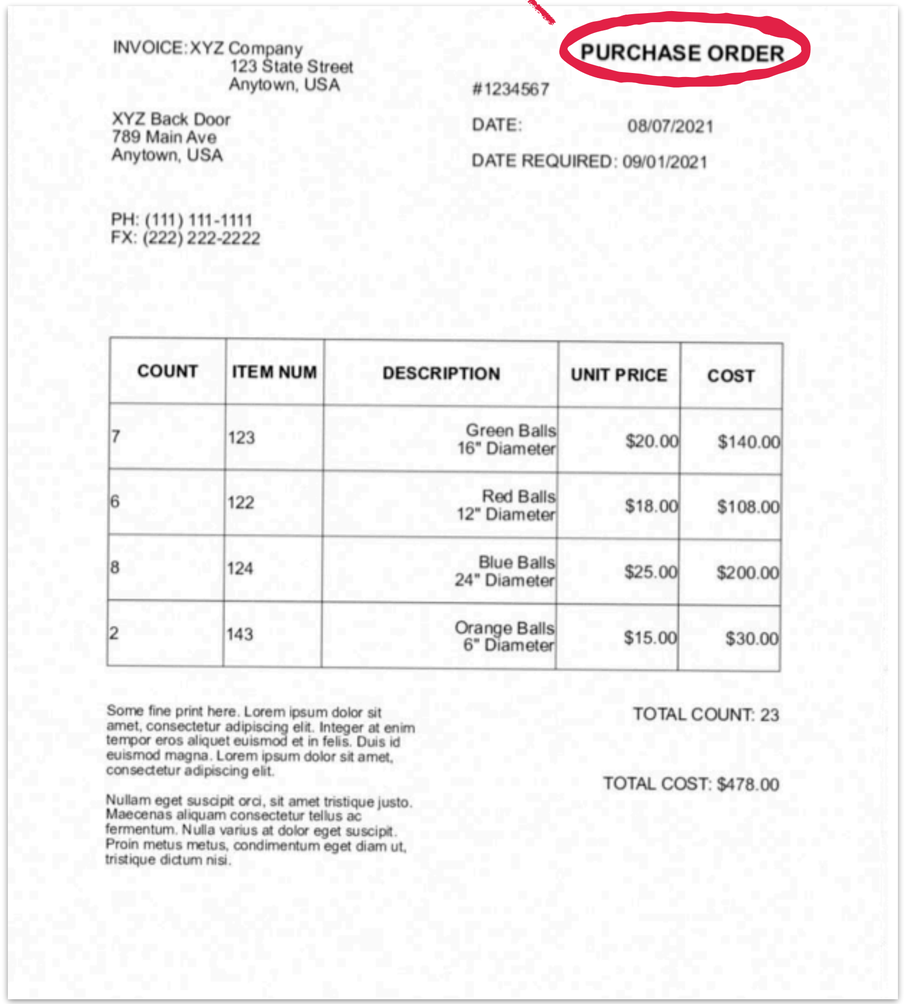


[Processing Data]

- Shallow pass data collection
- Enough to determine type
- Is there a title like...?
  - “Purchase Order”
  - “Invoice”
  - “Mortgage Application”



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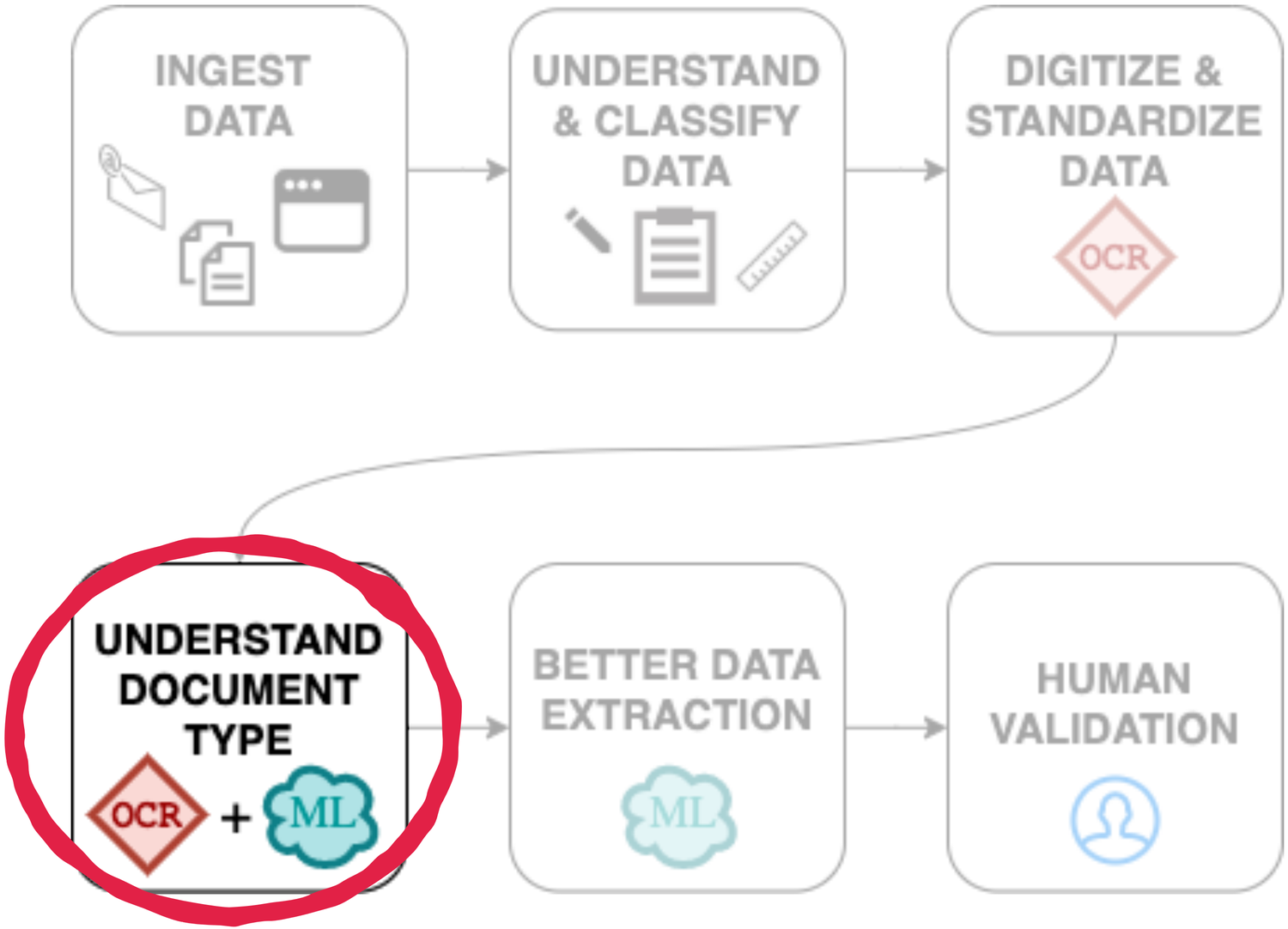
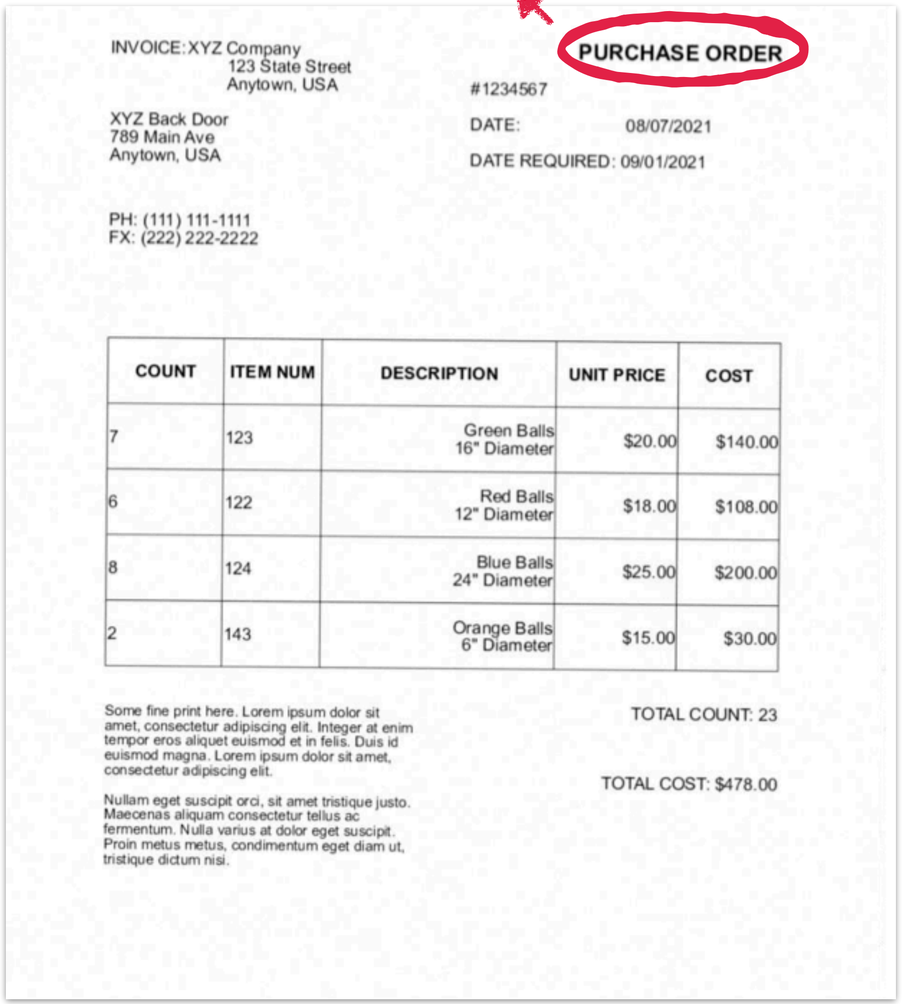


[Processing Data]

- Structured data is easy to understand type
- Semistructured & unstructured can be more difficult
- Are more than one document type ingested into the same system?
  - Purchase Orders
  - Invoices
  - Mortgage Applications

DOCUMENT TYPE:
PURCHASE ORDER



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2	143	Orange Balls 6" Diameter	$15.00	$30.00

Some fine print here. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Integer at enim tempor eros aliquet euismod et in felis. Duis id euismod magna. Lorem ipsum dolor sit amet, consectetur adipiscing elit.

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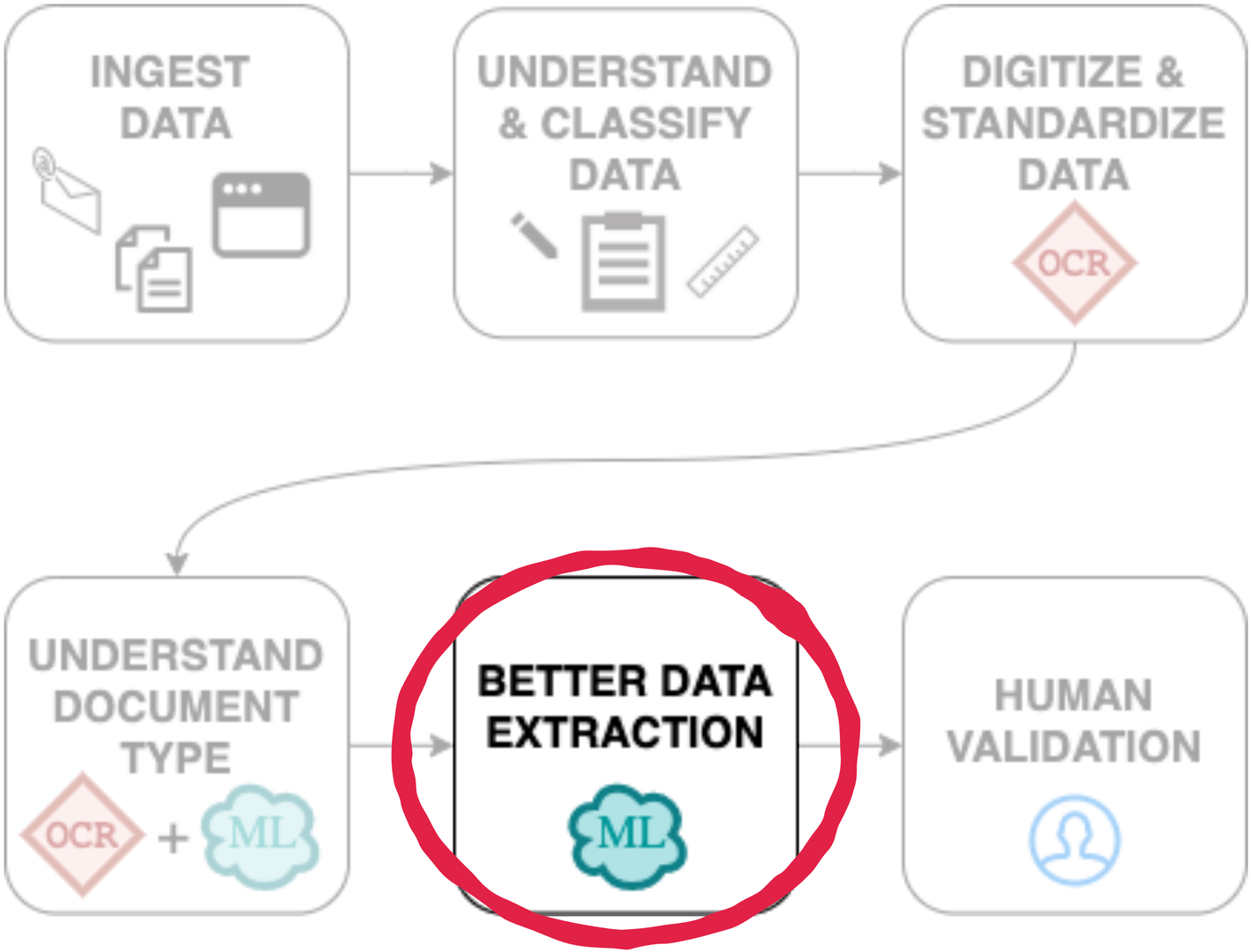
TOTAL COUNT: 23

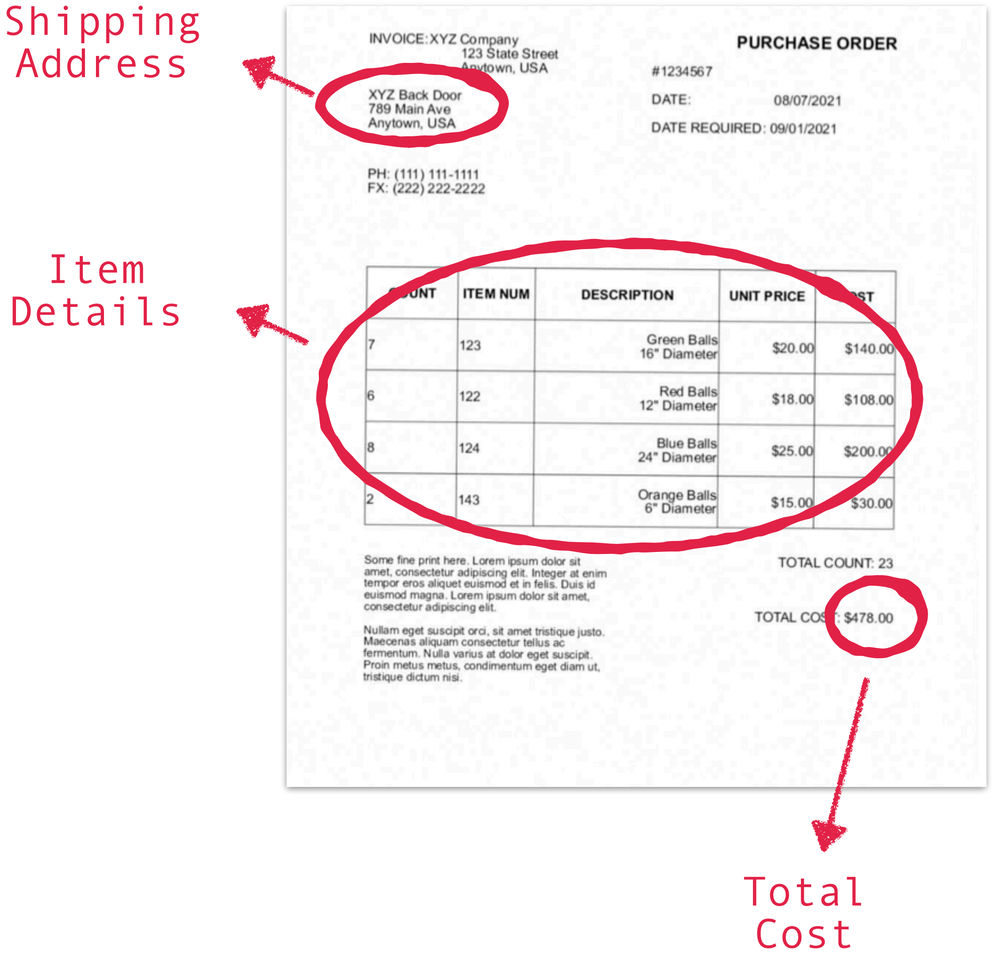
TOTAL COST: $478.00

[Processing Data]

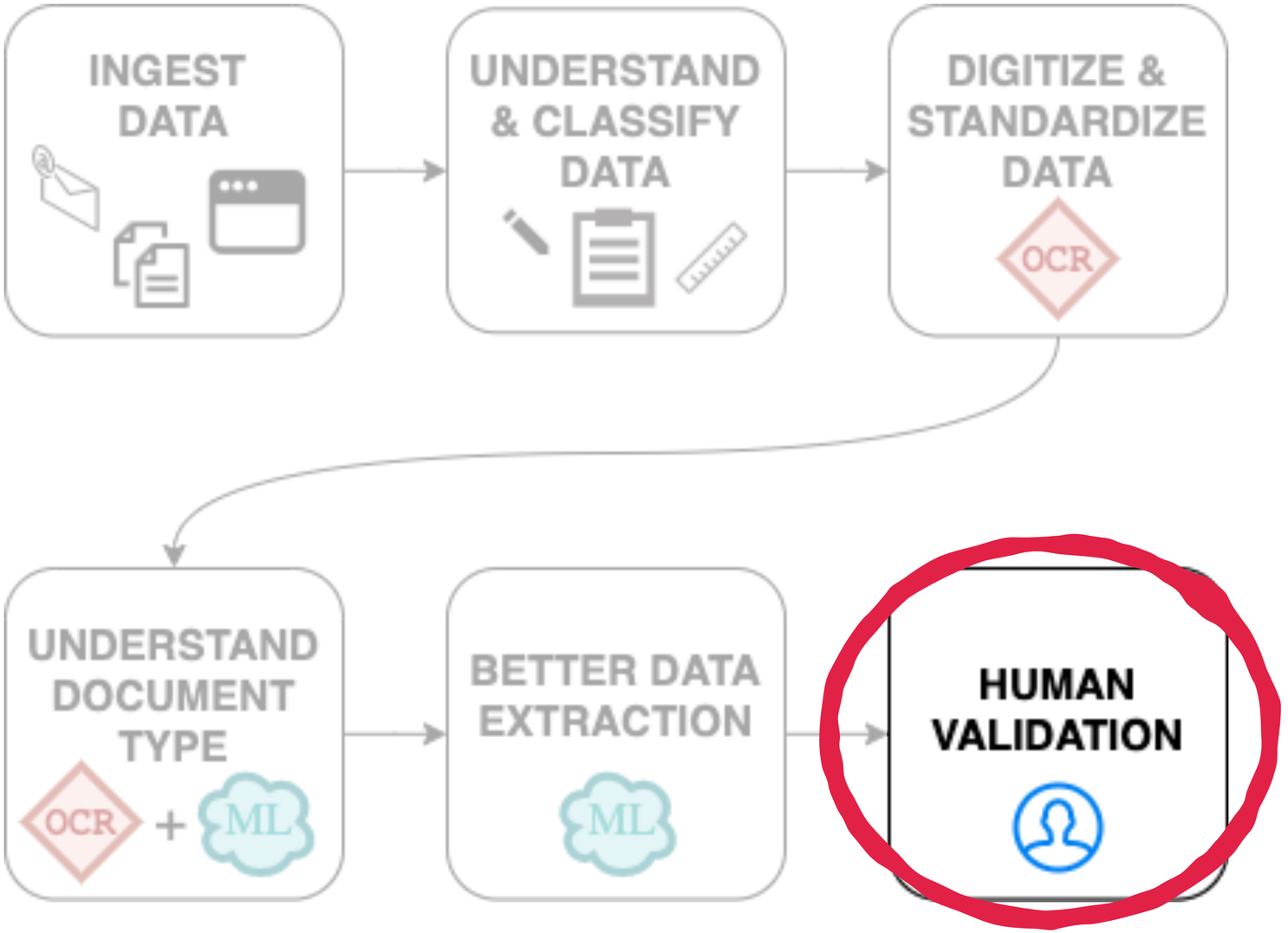


[Processing Data]

- Knowing the document type, we can extract more specifics
  - Shipping Information
  - Item Details Table
  - Total Cost
- If classified as semistructured or unstructured, we may need to leverage machine learning to map values to the correct keys.



[Processing Data]



[Processing Data]

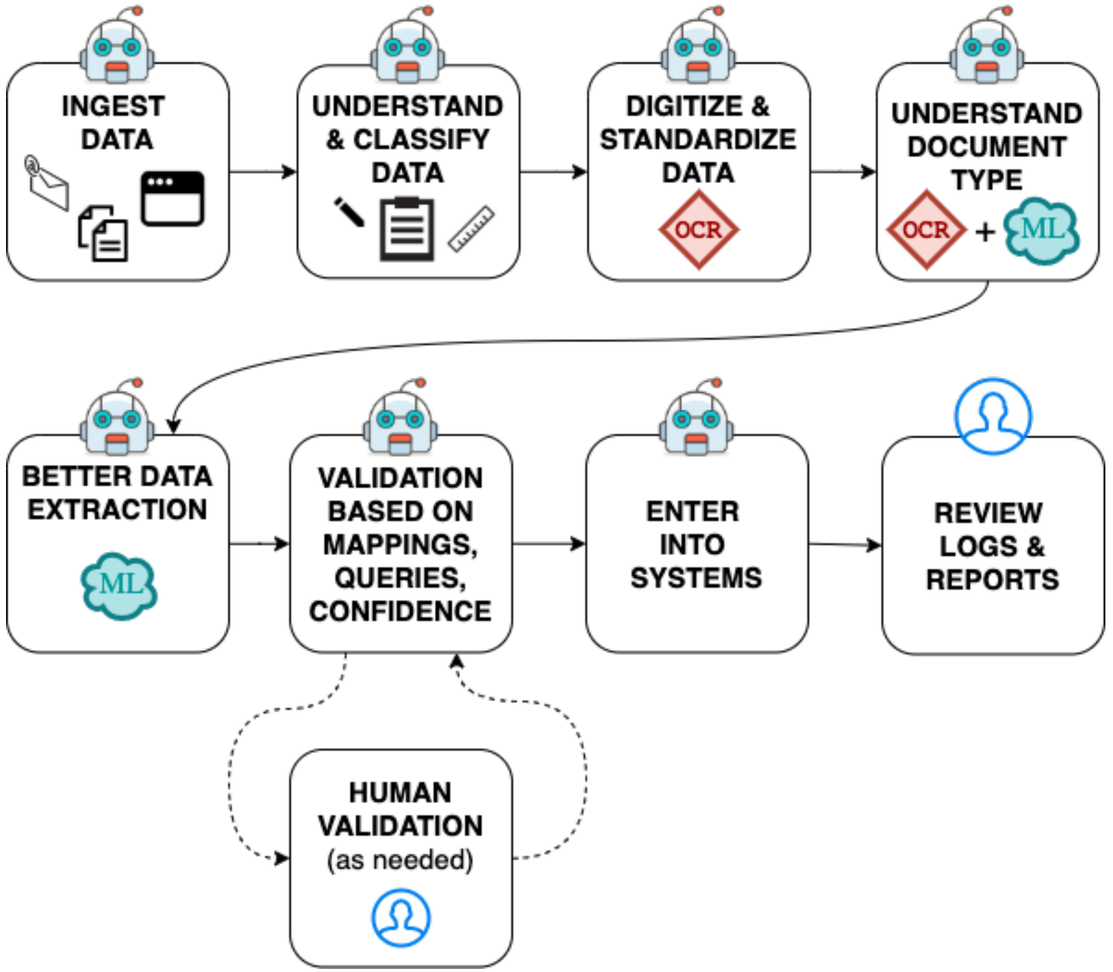
- Certain level of human-in-the-loop is necessary (and good)
  - Confirm accurate information
- Machine learning models improve with more samples and verifications
- Some cross-checking can be automated

How do we link this all together?

[Single Pipeline]

Robotic Process Automation

- Also known as RPA
- Method of automating repetitive tasks
- Often use the screen same as a live user would
  - Avoids the wait/requirement for application integration
- Perform faster, with accuracy, can run without stopping



[Single Pipeline]

Case Study: PepsiCo

- CHALLENGE
  - Slow document processing
  - Prone to errors
  - Very manual

- SOLUTION
  - Single process flow
  - ABBYY FlexiCapture

- RESULTS
  - Lower error rates
  - Reduced processing times
  - Team worked more efficiently

PepsiCo automates invoice processing with ABBYY FlexiCapture, 2021. [Online; accessed 13-August2021].

[Single Pipeline]

Case Study: Sysco

- CHALLENGE
  - Very manual processes
  - Prone to errors
  - Not enough time

- SOLUTION
  - Robotic Process Automation
  - Multiple departments and processes

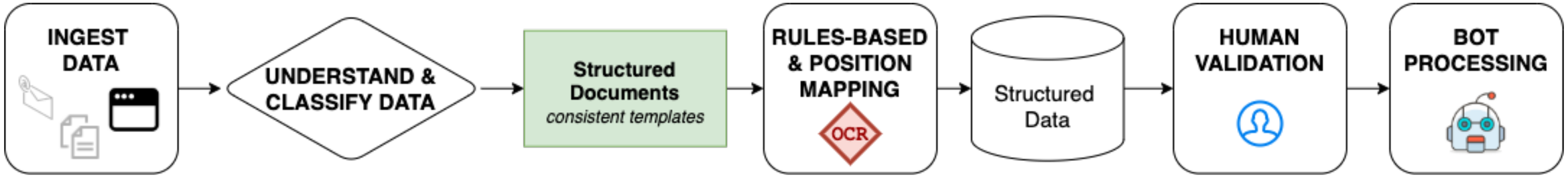
- RESULTS
  - Over 200,000 hours productivity saved in first 3.5 years
  - Built a culture of automation

Alison Major and Kim Meredith. Sysco: Scaling an rpa program without compromise, 2021. [Online; accessed 15-August2021].

Blue Prism Cafe´. Sysco: Scaling an intelligent automation program without compromise, 2021. [Webinar; accessed 15- August2021].

[Single Pipeline]

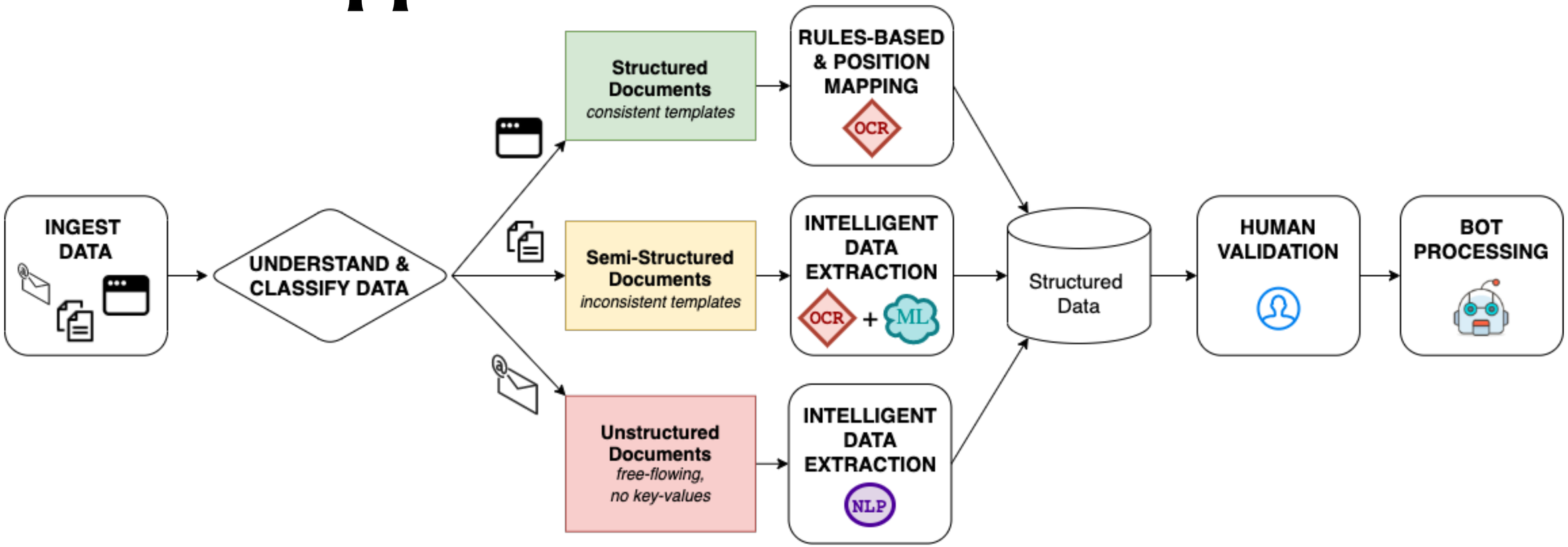
General Application



- Start with a single input method
- One classification (structured data)
- One document type
- Automate end-to-end using RPA

[Single Pipeline]

General Application



- Begin adding new ingestion methods that automatically tie into the existing process

[Solutions & Costs]

ABBYY FlexiCapture
- Best NLP, ML
- Automate & Integrate
- Starting at $0.028 per page

Amazon Textract
- Powerful OCR
- Built-in Human-in-the-Loop
- $0.0015 per page

Google Tesseract
- Open Source
- Less accurate
- Free

Microsoft PowerAutomate
- Variety of solutions available
- Easy to link processes

Monarch
- Good for Structured & Unstructured Data
- Desktop based

Blue Prism Decipher
- RPA Software
- Direct integration to OCR with human-in-the-loop

[Conclusion]

Is there a single method to receive multiple forms of information and automatically pull the desired data?

Many tools are available, but they can be combined into a single solution.

Consider including RPA to make your solution more robust.

Start small, then build more methods to ingest different document types.