

AI DOCUMENT AUTOMATION

Curious AI Ltd.

Timo Haanpää, COO, Co-Founder

Curious AI in brief

Deep tech startup:

Curious AI is building the future of knowledge work.
Sells **Industrial** and **Enterprise Automation**.

CAI builds Digital Co-Worker technology, based on original AI research and a strong patent portfolio.

Key personnel: 25 AI specialists, ex-NVIDIA,
ex-ZenRobotics, ex-Google, ex-Amazon ...
the staff includes a dozen serial entrepreneurs.

Founded 2015, HQ in Helsinki, Finland.
Backed by 6 international investors.



Agenda

**01 Why solve Documents with AI today
(Surely there are other tasks for AI?)**

02 Document Automation

03 Current implementation



01

THE PROBLEM WITH DOCUMENTS

Why automate the tasks we do today?

In the main, the work of us humans is still repetitive cognitive tasks (a.k.a. **dumb**).

Amazingly, for 2018, a typical human knowledge task is **A) data entry into** or **B) moving data between** IT systems.



Why we should today automate IT?

Humans still perform very repetitive work.

- E.g. read and interpret the invoices, enter data to a system, request approval, verify, pay, ...

Robotic process automation (RPA) helps, but not much.

- Limited to strict, rule-based operations.
- RPA cannot process unstructured information.
- New features "Can you also get these EU Customs Codes from my invoices" very hard to implement.

Data is a critical limitation. Advanced AI helps.

- Almost anything outside a database is unstructured, from a computer's perspective.
- 80% of enterprise data is currently unstructured.*

(*says AutomationAnywhere, an RPA provider)

Why invoice handling?

Knowledge work is tasks: tasks can be automated gradually: in part or in full.

- CAI has 10+ years of process industry experience: we know AI uptake there will be more gradual.
- However, enterprise human knowledge tasks are often fully in the digital environment: there the **AI solutions can be deployed rapidly.**

A common knowledge task is to understand documents humans write to one another.

- Curious AI's first digital co-worker understands layouts: structured information. **Invoice handling.**
- The cost of processing a regular invoice has been estimated at 5-12€ each. Every company handles invoices, but most don't even know at what cost.
- Human work in invoice handling is often manual data entry: sums or line items, or rote checking.
- Increasingly difficult sub-tasks found e.g. in accounting codes or payment verification.

Invoice handling

Steps in a traditional human process:

- 1 Read invoice and structure the data
- 2 Assign in accounting: add codes.
- 3 Add needed descriptions
- 4 Business approval chain
- 5 Verification of payments
- 6 Perform financial transaction

How to automate? (*implementation difficulty*)

- 1 AI Document Interpreter (*Medium*)
- 2 AI or traditional rule-based (*Easy*)
- 3 Generate human-readable text (*Difficult*)
- 4 Value understanding (*Very difficult*)
- 5 Multifactor risks analysis (*Medium: risky*)
- 6 Existing transaction solutions (*Trivial*)



02 CURIOUS AI INVOICE AUTOMATION

Structured Data: Humans vs Computers

The kind of data that us humans understand and consider well-formed is **not computer-friendly**.



For us humans, this is well-structured data

Logo symbol in the correct, expected place.

Prominently displayed company name.

Line items.

Boxes and lines which clarify the information.


Sums.

Signatures.

Well-wishes and explanatory slogans.

ALL OFFERS SUBJECT TO PROMPT ACCEPTANCE.

CONSIGNMENT



WM. J. BOEHNER & CO.
RAW FURS AND GINSENG

FACTORY: BROOKLYN, N. Y. 159-163 WEST 25TH ST. NEW YORK CITY

Main Office: NEW YORK, N. Y.
Factory: BROOKLYN, L. I.
Branch: ANTIETAN, W. VA.

Name The Berliner Co., Date March 15, 1919.

Dear Sirs:— Gorry, Pa.

We are pleased to make the following offer on your shipment:

Our Lot No.	NET WEIGHT Lbs.	ONS.	FURS	DESCRIPTION	Year	Amount	AMOUNT
2722	18			ginseng at		18.00	per lb.

REMARKS:

Approved by *Alister* Yours very truly, WM. J. BOEHNER & CO.

For a computer, this is only pixel mush

Invoices are for example:


- On paper
- Scanned from paper to PDF
- A generated PDF
- In some electronic interchange format

PDF is a only a collection
of text inside boxes:

- OCR systems can read a paper to e.g. PDFs, but they add errors.
- OCR text-box soup is very hard to interpret for traditional programs.
- The OCR process loses the paper's original information structure!

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2722	18		Ginseng at		18.00	per lb.

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Advanced Finland ...

- Since 1999, a concerted move into XML-based (EDI, Finvoice) formats.
- Widely used: 70% of all businesses offer and use e-invoicing.
- 40% of all B2B invoices in e-invoice format in 2015.



Advanced Finland ...

- Since 1999, a concerted move into XML-based (EDI, Finvoice) formats.
- Widely used: 70% of all businesses offer and use e-invoicing.
- 40% of all B2B invoices in e-invoice format in 2015.
- **Does not really work.**



Machine learning to the rescue!

Teach a neural network to connect meanings based on visual cues.

- Recover the form data. Feed to traditional IT systems.
- E.g. send the extracted line items from PDF invoices and any structured data to the financial system in use.

AI systems evolve fast, by training, as new forms and inputs are encountered.

- This approach is applicable to most forms of unstructured data.
- Scanned or natively inputted PDF forms.
- Emails containing the same info, but coming in different formats.
- Free-text entries in database can be further structuralized.

Human-computer work team can solve the original problem.

- The AI system understands when the results are not reliable - the system can ask a human co-worker to help.
- In every case where the human trains the AI system the result is stored and no further training is needed.

Uncertainty is the key

The key feature Curious AI offers is uncertainty representation. Other AI solutions cannot presently communicate in a reliable manner how their results are uncertain.

- Curious AI has developed a proprietary neural network implementation which can reliably **measure and display** what aspects of the learning results are unreliable, and how.
- For example, a relatively clear-cut document understanding system which automates the above example invoices has to:
 - Find all invoice line items, and only them.
 - Segment descriptions from the line item sums.
 - Recognise modifications to the invoice total, e.g. various tax bases such as VAT.
 - Possibly identify multiple currencies used.

03 CURRENT IMPLEMENTATION

Key feature

How the Curious AI solution understands human-written documents:

- The fluid UI enables all users to teach the system themselves.
- Today Curious AI's solution is fully adapted to the user's existing environment and workflow: deployed as embedded controls.
 - E.g. a browser plugin that highlights the understanding targets as overlay: what data the system has pre-filled.
 - The user can edit the system's proposals directly.

3 solution modalities available:

- Fixed fee: REST API with authentication
- Per transaction: SaaS from B2B app stores
- Tech licensing: On-site server deployment
- Data ingested via API, e-mail, batch uploads etc.

An example: Curious AI invoice solution process

The process starts with optical character recognition (OCR).

01. Find interesting named entities, e.g., currency amounts
02. Approximate recognition with regular expressions
03. Form candidate contexts for each info
Choose closest / most significant context
04. Use keyword lists etc.
05. Categorize data based on context
06. Normalized leveraging for known facts
E.g. match against known supplier list

The image shows a screenshot of an invoice with several elements highlighted to illustrate context recognition. A blue dashed circle highlights the entire invoice content. A green rectangle highlights the 'Clothes' row in the item table, including its quantity, rate, and amount. A red rectangle highlights the '\$512.00' amount for the 'Clothes' row. A pink rectangle highlights the 'Total: \$11,977.28' at the bottom of the invoice.

Item	Quantity	Rate	Amount
Clothes	1	\$512.00	\$512.00
Boots	2	\$42.00	\$84.00
Motorcycle	1	\$9,001.00	\$9,001.00

Bill To: **The Curious AI Company Oy**
Hietaniemenkatu 2
Finland

Balance Due: **\$11,977.28**

Subtotal: \$9,597.00
Tax (24%): \$2,303.28
Shipping: \$77.00
Total: **\$11,977.28**

Horizontal and vertical contexts recognised.

Results from the automated solution

For the Workforce

- More time for interesting, challenging tasks.
- Less tedious, manual work.

For the Enterprise

- Happier employees doing more meaningful work.
- Scale to new business opportunities.
- Structured data opens up further automation possibilities.

For IT systems department

- Actual users and domain experts tune the system: No IT involvement.
- Simple SaaS solution maintained by Curious AI or in-house IT.
- Long term roadmap for general document structuralization.

Customer's view: over 80% automated

The pilot case is the hardest Curious AI could find. A leading IPR agency in EU, Berggren Group, receives 20.000+ invoices/year, from anywhere in the world.

30% of invoices: automatic

- The customer estimates that one-third of the invoices are handled by the system in a fully automated manner.
- All line items correctly input, tax bases and currencies OK.

30% of invoices: one-click

- Of the remaining 70% a little less than half require a single user check-up or edit.
- Curious AI is a pioneer in fast learning. The AI solution can learn from a single correction and e.g. an OCR problem will not be presented again.

20% of invoices: two edits

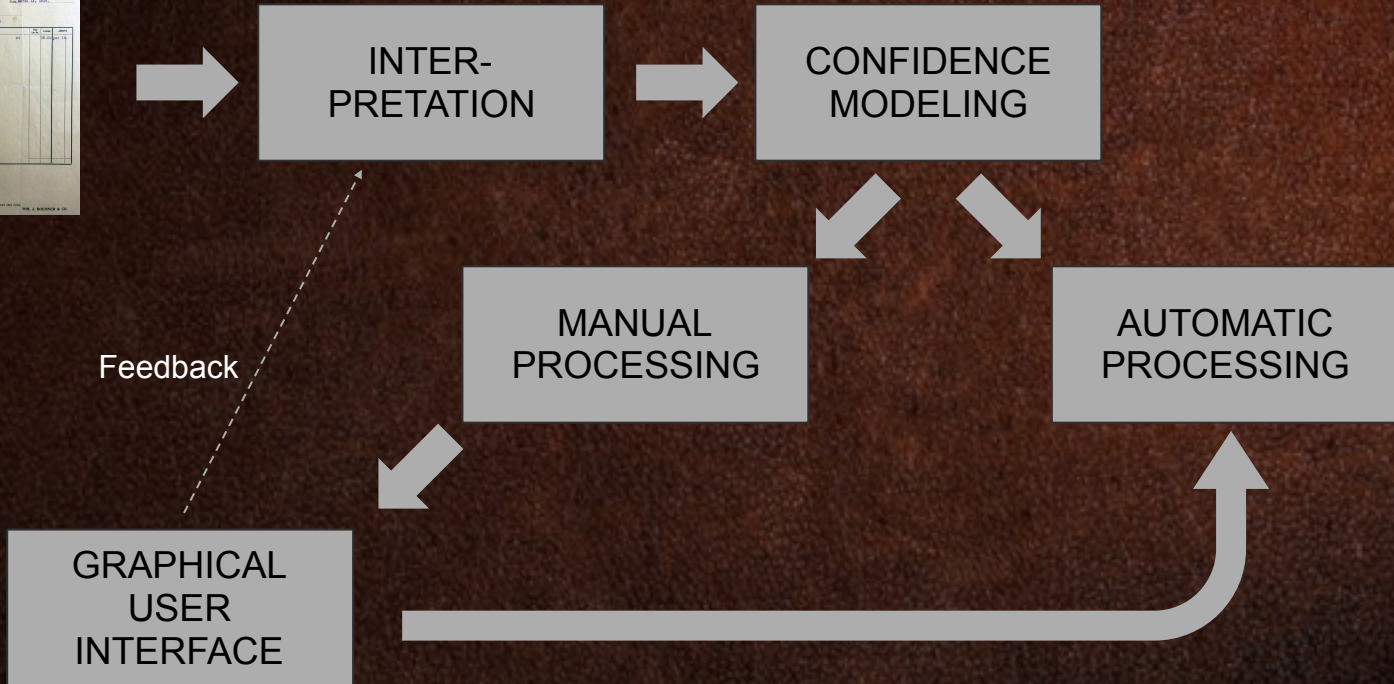
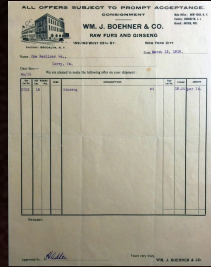
- In testing, half of the remaining 40% has required 2 edits from the user.
- **Only 20% of the invoices** require the traditional human-powered process.

Thank you!

For further information,
please e-mail: sales@cai.fi

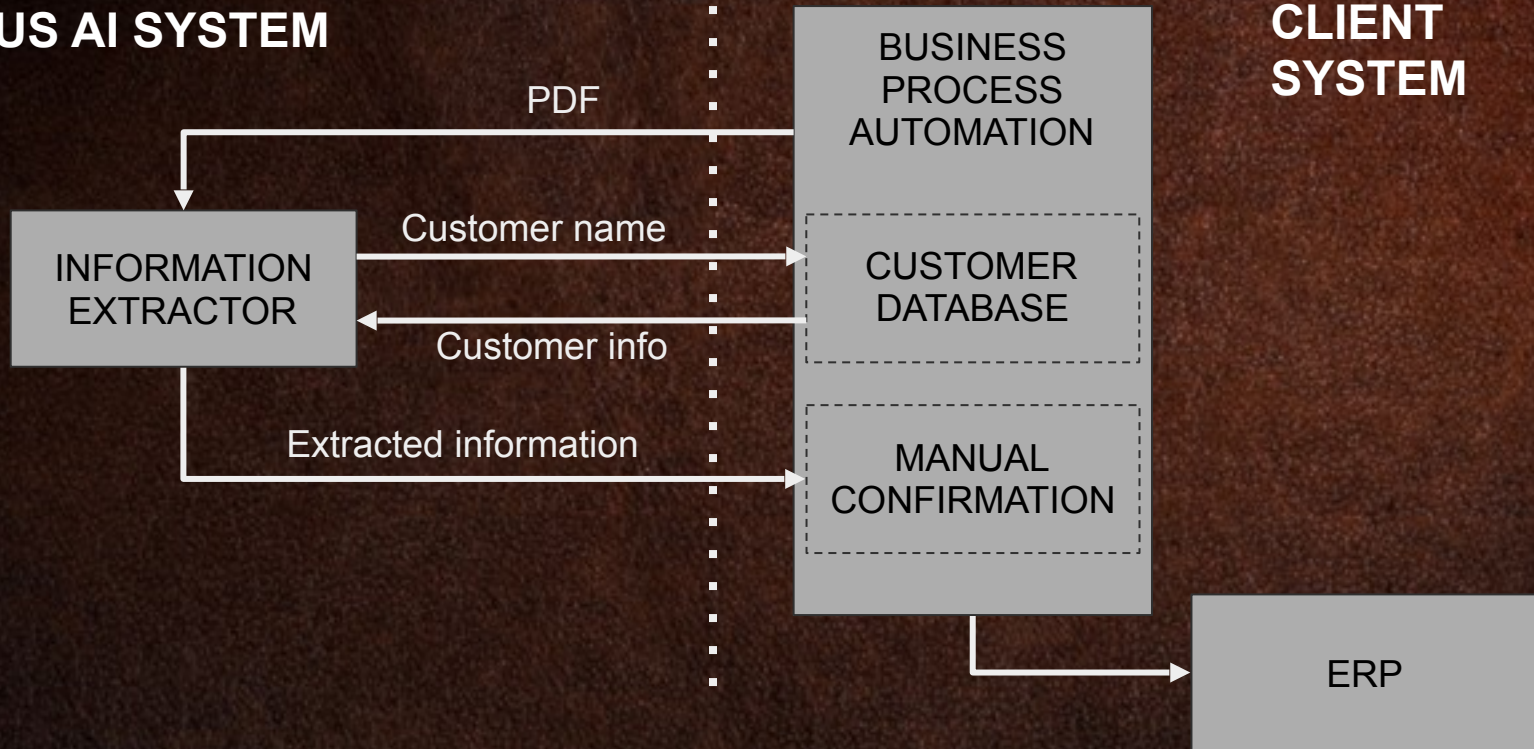


Exception Processing, Teaching



Business Integration

CURIOUS AI SYSTEM



Business Integration - final form

CURIOUS AI SYSTEM

