

# API error handling with Machine Learning



Beautiful accounting software



Steven Cooper  
[@developersteve](https://twitter.com/developersteve)



717,000+  
global subscribers

# @xeroapi

**XeroAPI**  
@XeroAPI

The API & developer partner programs for Xero - beautiful accounting software

Global  
[developer.xero.com](http://developer.xero.com)  
Joined November 2008

143 Photos and videos

TWEETS 2,312 FOLLOWING 764 FOLLOWERS 5,367 LIKES 248 LISTS 1

Pinned Tweet

**XeroAPI** @XeroAPI · Aug 31

Straight outta #xerocon these gangstas will be featuring in #DevTV ep06 due out next month. Be prepared... ^DY

0:04 till

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You may also like · Refresh

- xero** Xero accounting app ✅  
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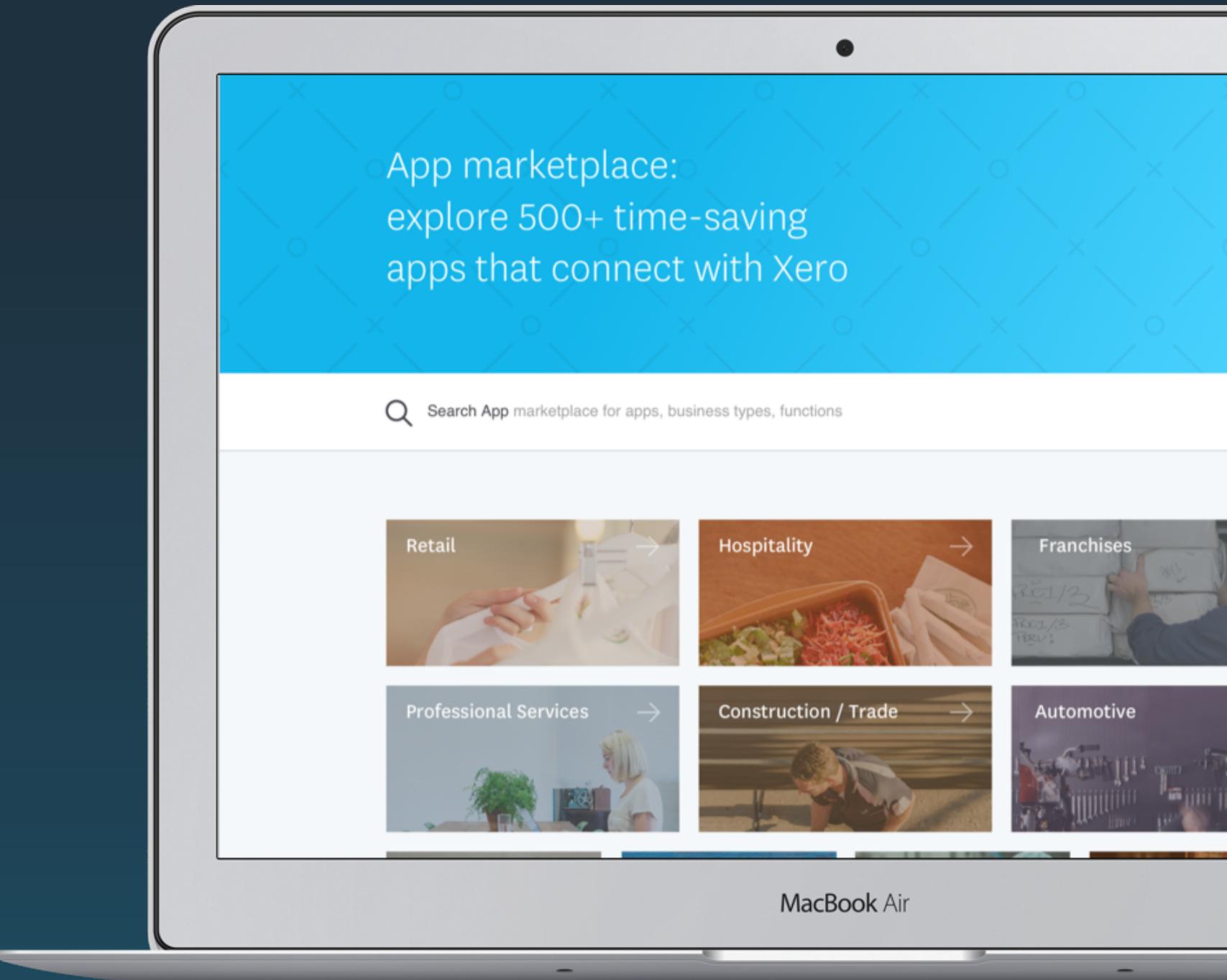
Trends

- #HappyBirthdayBeyonce  
67.3K Tweets
- #PYLUpAZ



# Xero Marketplace

- New design
- Verticals - ‘Packages’
- 500+ connected apps



# Xero APIs

xero

## DEVELOPER

stories, insights and updates from the Xero Dev team

API RELEASES CULTURE DEVELOPERS DESIGN

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Steve Roberts  
4 days ago · 11 min read

### The Butterfly Effect—or development by numbers

To developers, designers and product people, software is made up of bits

xero Xero Developer

The API & developer partner programs for Xero—beautiful accounting software developer.xero.com

# API logs

[◀ Back](#) Showing rows 1 to 16 for ML test app [Next ▶](#)

All	Http 2xx	Http 4xx	Http 5xx				
Log Date (UTC)	Organisation Name	Method	Endpoint	Request Size	Response Size	Processing Time	Status
04-Oct-2016 04:24:53.467	Organisation A	POST	leaveapplication	342 B	564 B	498ms	400 
04-Oct-2016 01:39:19.710	Organisation B	POST	leaveapplication	344 B	195 B	547ms	404 
03-Oct-2016 07:02:31.023	Organisation A	POST	leaveapplication	333 B	555 B	596ms	400 
03-Oct-2016 01:36:15.373	Organisation C	POST	leaveapplication	291 B	149 B	56ms	400 
27-Sep-2016 07:17:59.380	Organisation C	POST	leaveapplication	324 B	149 B	44ms	400 
23-Sep-2016 01:36:12.097	Organisation A	POST	leaveapplication	339 B	561 B	557ms	400 
21-Sep-2016 03:35:43.403	Organisation A	POST	leaveapplication	328 B	550 B	530ms	400 
21-Sep-2016 03:35:41.450	Organisation A	POST	leaveapplication	328 B	550 B	661ms	400 
21-Sep-2016 03:35:39.367	Organisation A	POST	leaveapplication	328 B	550 B	631ms	400 
21-Sep-2016 03:34:34.690	Organisation A	POST	leaveapplication	328 B	550 B	852ms	400 
21-Sep-2016 00:03:58.173	Organisation B	POST	leaveapplication	344 B	195 B	1s 846ms	404 
20-Sep-2016 23:57:15.743	Organisation B	POST	leaveapplication	328 B	195 B	1s 837ms	404 
19-Sep-2016 11:30:05.423	Organisation A	POST	leaveapplication	328 B	550 B	923ms	400 
16-Sep-2016 02:02:53.723	Organisation D	POST	employee	831 B	684 B	33ms	400 
08-Sep-2016 01:42:26.603	Organisation B	POST	leaveapplication	326 B	195 B	1s 137ms	404 
08-Sep-2016 01:41:57.677	Organisation B	POST	leaveapplication	333 B	195 B	1s 199ms	404 



# Status 400



400

Bad Request



# Status 500



**500**

Internal Server Error



# Error patterns

- Missing post/put data
- Non existent record GET requests
- Data formatting
- Functional system interaction



# Get Requests

Response Code: **404 NotFound**

Request URL:

```
GET /api.xro/2.0/invoices/07f29d77-16ca-48ab-a785-d8ef8dee335d
```

Request (0 bytes):

Response (47 bytes):

```
The resource you're looking for cannot be found
```



# Data Formatting

Response Code: **400 BadRequest**

Request URL:  
PUT /api.xro/2.0/invoices

Request (548 bytes):

```
<Invoices>
<Invoice>
<Type>ACCREC</Type>
<Contact>
<Name>Martin Hudson</Name>
</Contact>
<Date>0016-10-05T00:00:00</Date> ←
<DueDate>2016-10-12T00:00:00</DueDate>
<LineAmountTypes>Exclusive</LineAmountTypes>
<LineItems>
<LineItem>
<Description>Monthly rental for property at 56a Wilkins Avenue</Description>
<Quantity>4.3400</Quantity>
<UnitAmount>395.00</UnitAmount>
```

Response (1,477 bytes):

```
<ApiException xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
<ErrorNumber>10</ErrorNumber>
<Type>ValidationException</Type>
<Message>A validation exception occurred</Message>
<Elements>
<DataContractBase xsi:type="Invoice">
<ValidationErrors>
<ValidationError>
<Message>The date 10/5/0016 is not valid</Message>
</ValidationError>
</ValidationErrors>
<Contact>
<ContactID>8ffc9aab-34c5-4fa6-970a-c3972459563d</ContactID>
<Name>Martin Hudson</Name>
</Contact>
```



# Function System Interaction

Response Code: **400 BadRequest**

Request URL:

```
POST /payroll.xro/1.0/LeaveApplications
```

Request (339 bytes):

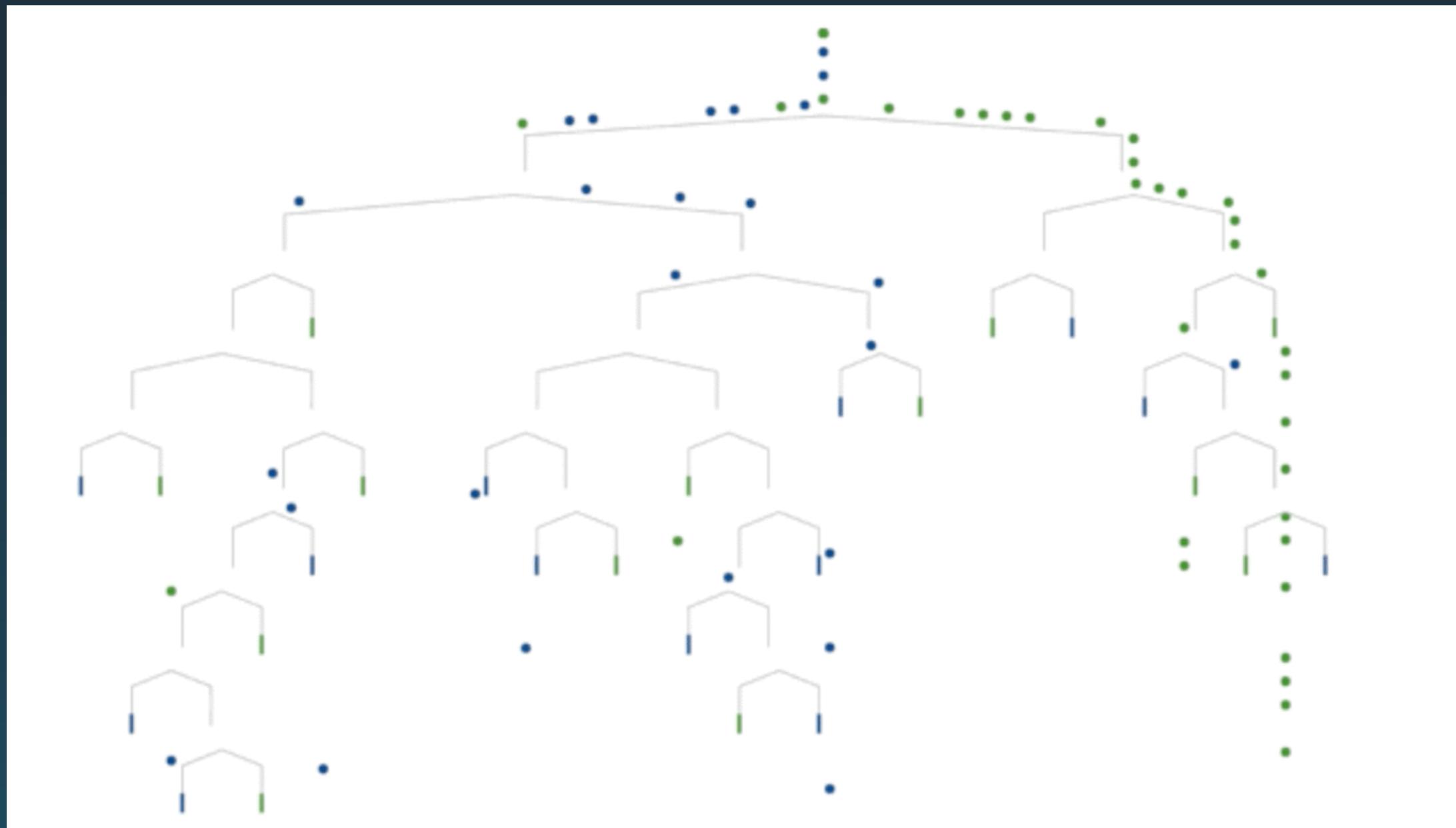
```
<LeaveApplications>
  <LeaveApplication>
    <EmployeeID>d99b5523-e123-4531-95b9-434149abb328</EmployeeID>
    <LeaveTypeID>46c13ace-16cb-489a-8900-d0a74a3e351a</LeaveTypeID>
    <Title>Planning vacation </Title>
    <StartDate>2017-07-02</StartDate>
    <EndDate>2017-07-16</EndDate>
  </LeaveApplication>
</LeaveApplications>
```

Response (561 bytes):

```
{"Id":"7c6ba630-b2f4-4525-b48a-3c43001cb7bd","ProviderName":"ML test app","ErrorNumber":10,"Type":"ValidationException","Message":"A validation exception occurred","LeaveApplications":[{"ValidationErrors":[{"Message":"Unable to create leave request. This leave type has to be assigned to this employee to create and process a leave request."}],"EmployeeID":"daaa5523-e123-4531-95b9-4341490bb328","LeaveTypeID":"46aa3ace-16cb-489a-8900-d0274a3e351a","Title":"Planning vacation","StartDate":"/Date(1498953600000+0000)/","EndDate":"/Date(1500163200000+0000)"}]}
```



# Machine Learning



# Xero & Machine Learning



# Machine Learning & Accounting Reconciliation

Reconcile (28) Cash Coding Bank statements Account transactions

What's this?

Review your bank statement lines...

	Spent	Received
<input checked="" type="checkbox"/> 19 Mar 2015 Ridgeway University INV-0035	other More	<a href="#">Create rule</a> <b>6,187.50</b>

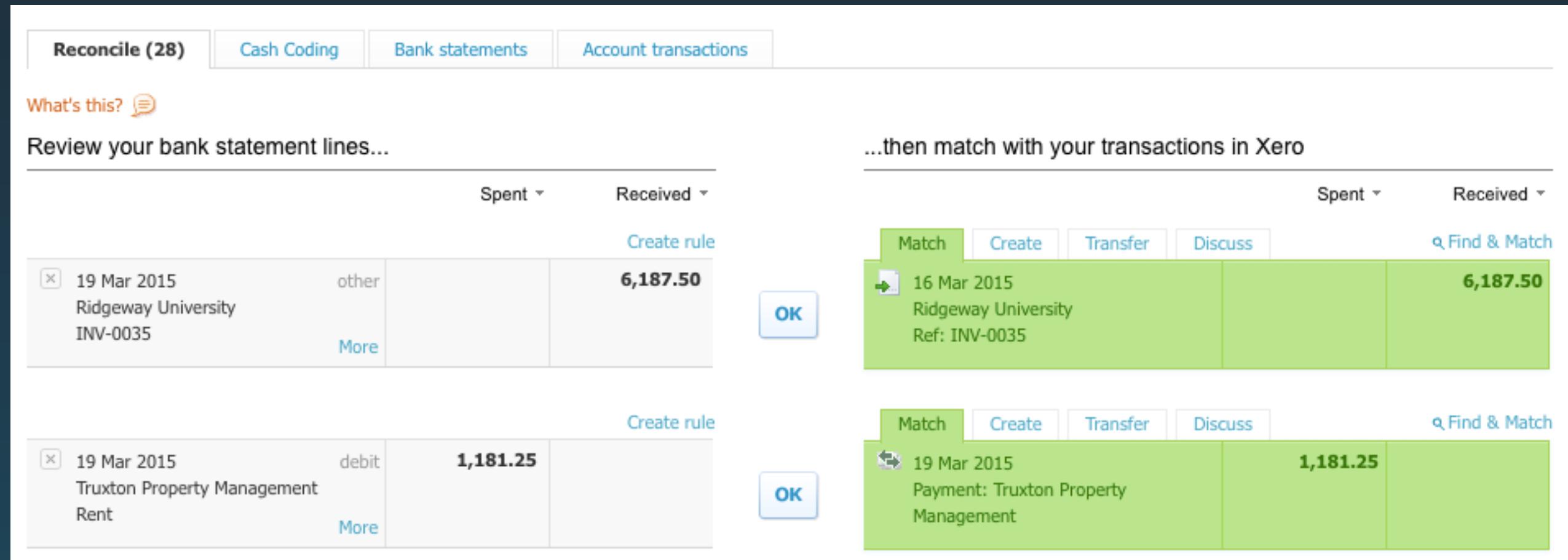
**OK**

...then match with your transactions in Xero

	Spent	Received
<a href="#">Match</a> <a href="#">Create</a> <a href="#">Transfer</a> <a href="#">Discuss</a> 16 Mar 2015 Ridgeway University Ref: INV-0035		<a href="#">Find &amp; Match</a> <b>6,187.50</b>

	Spent	Received
<a href="#">Match</a> <a href="#">Create</a> <a href="#">Transfer</a> <a href="#">Discuss</a> 19 Mar 2015 Payment: Truxton Property Management	<a href="#">Find &amp; Match</a> <b>1,181.25</b>	

**OK**



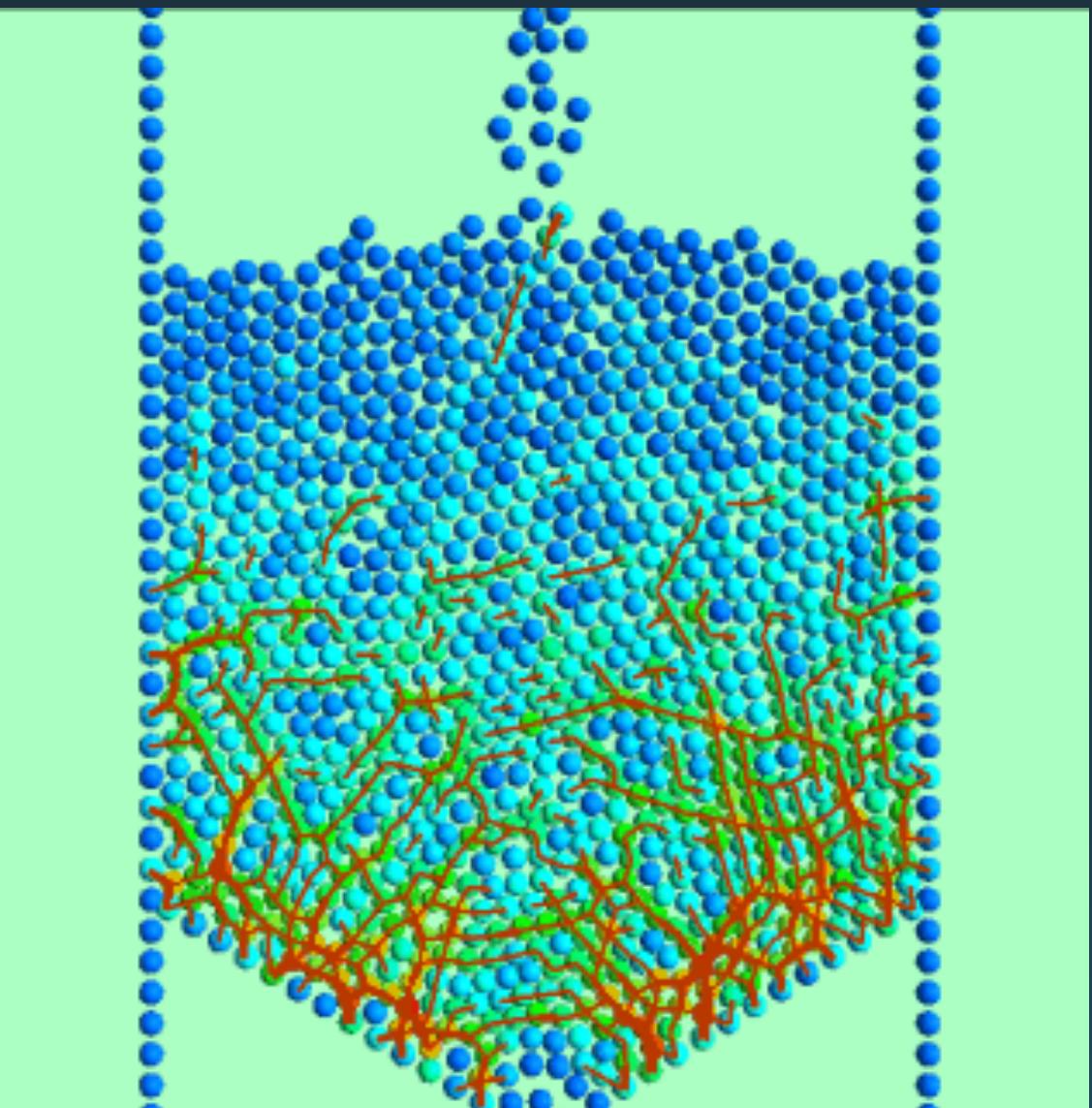
# Machine Learning 101



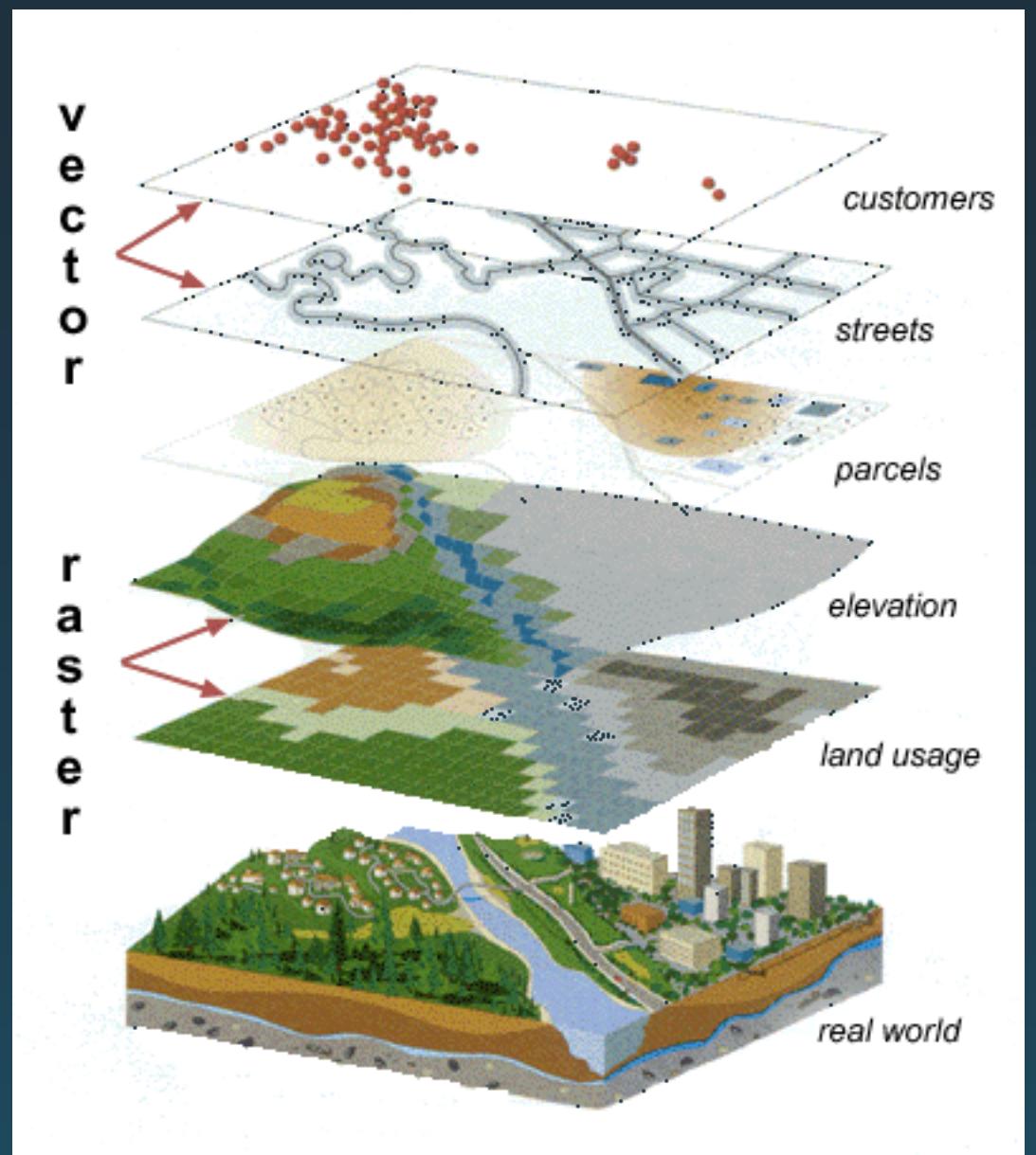
# Knowing the Question and the Answer



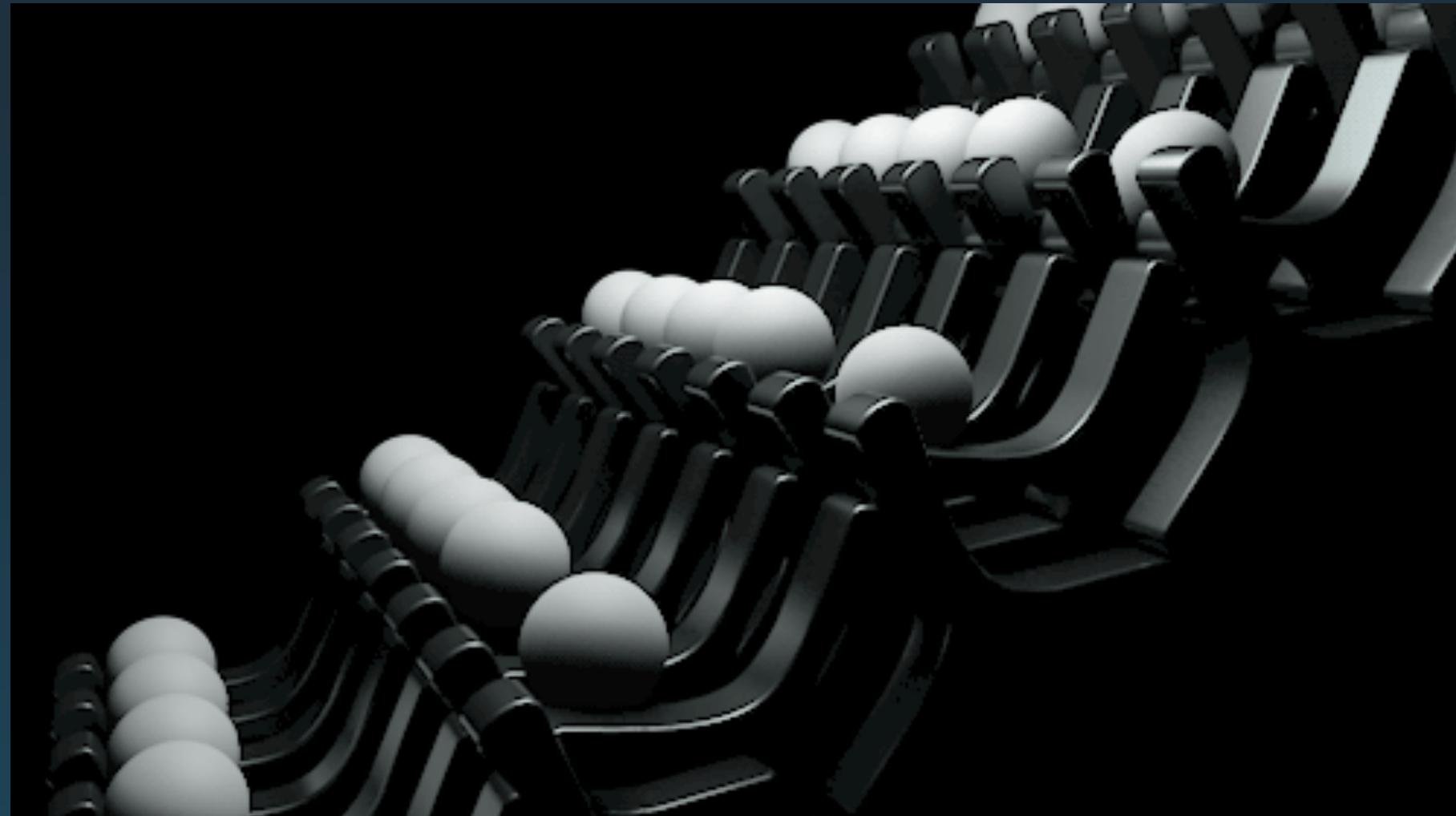
# Granular Data



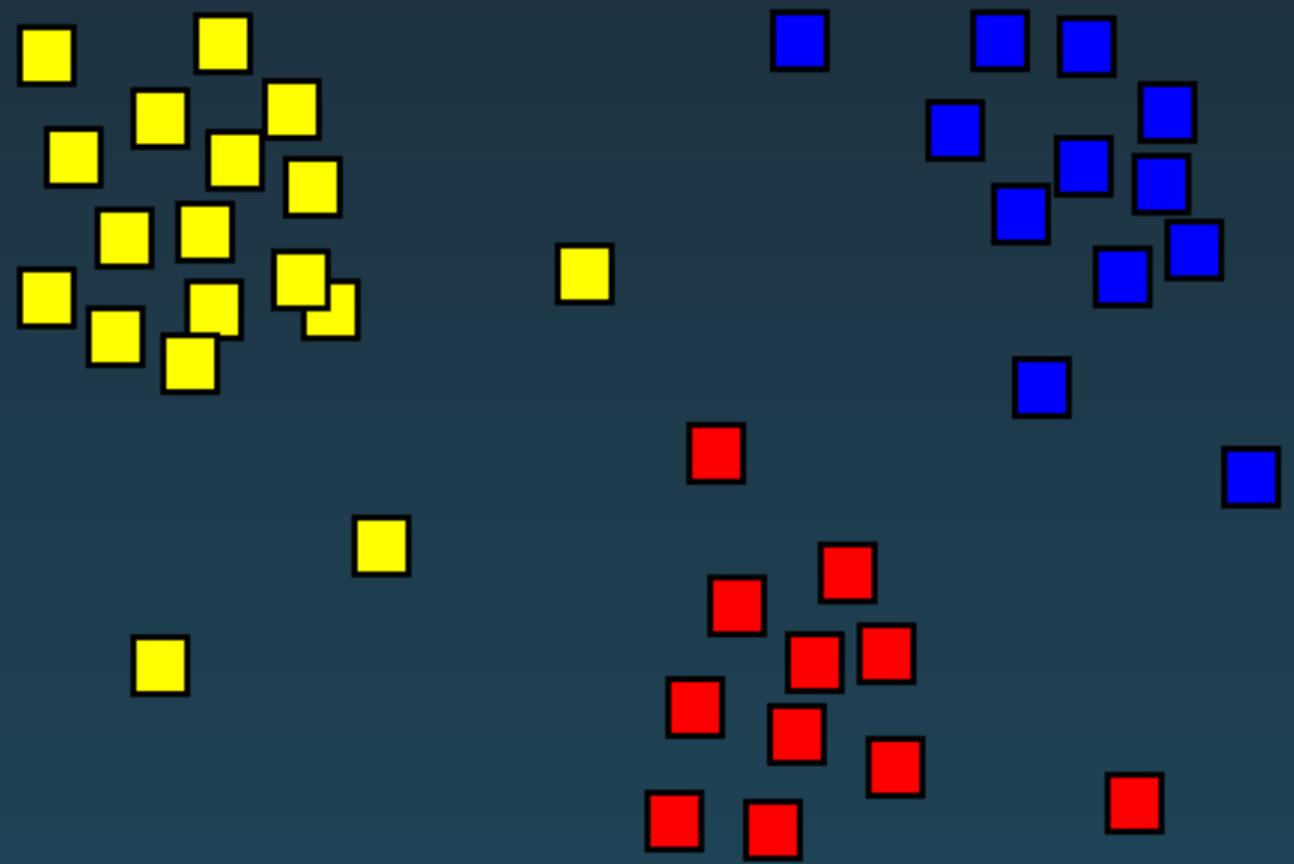
# Geospatial Analytics



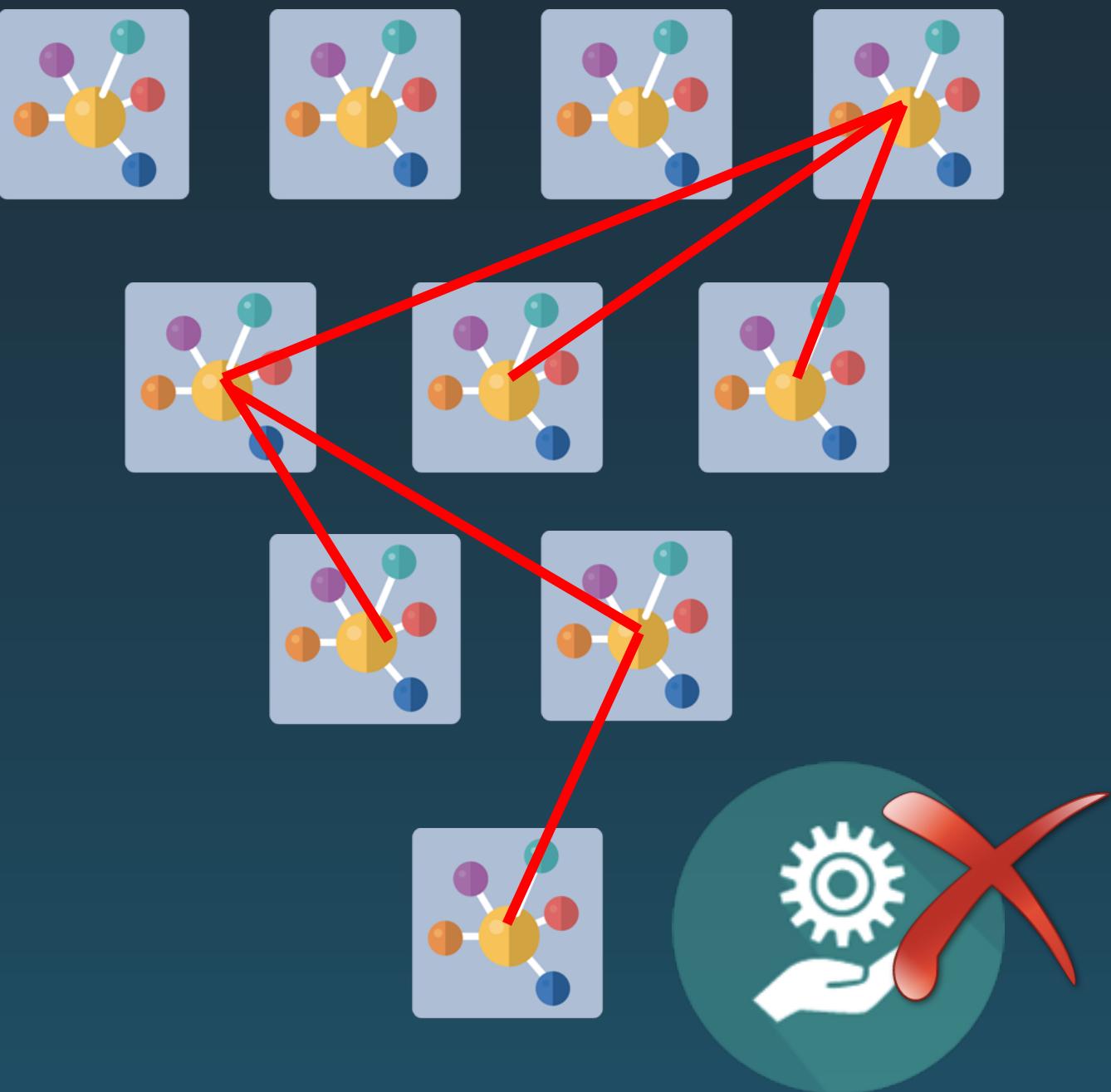
# Consistent session set errors



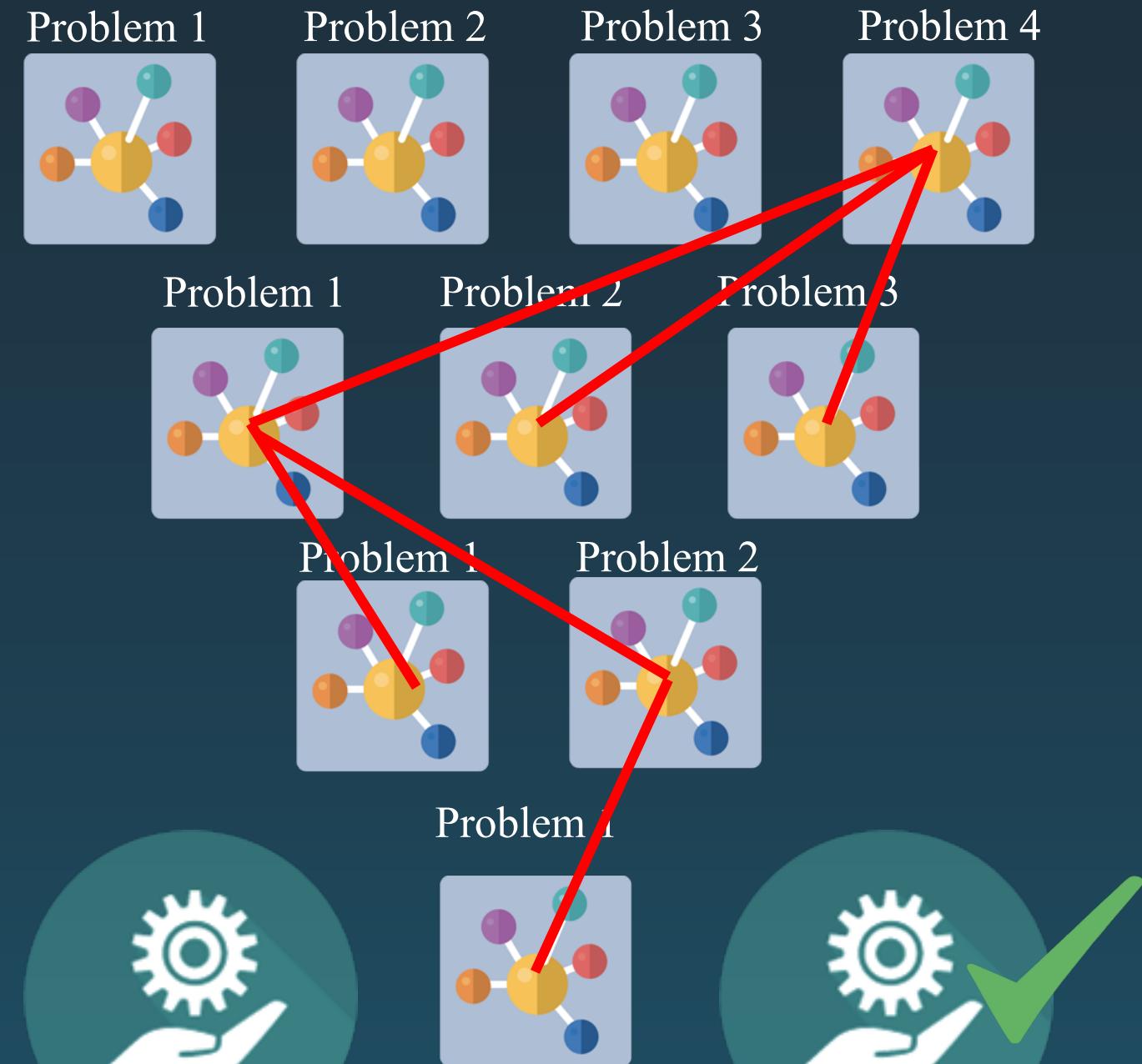
# Problem Clustering



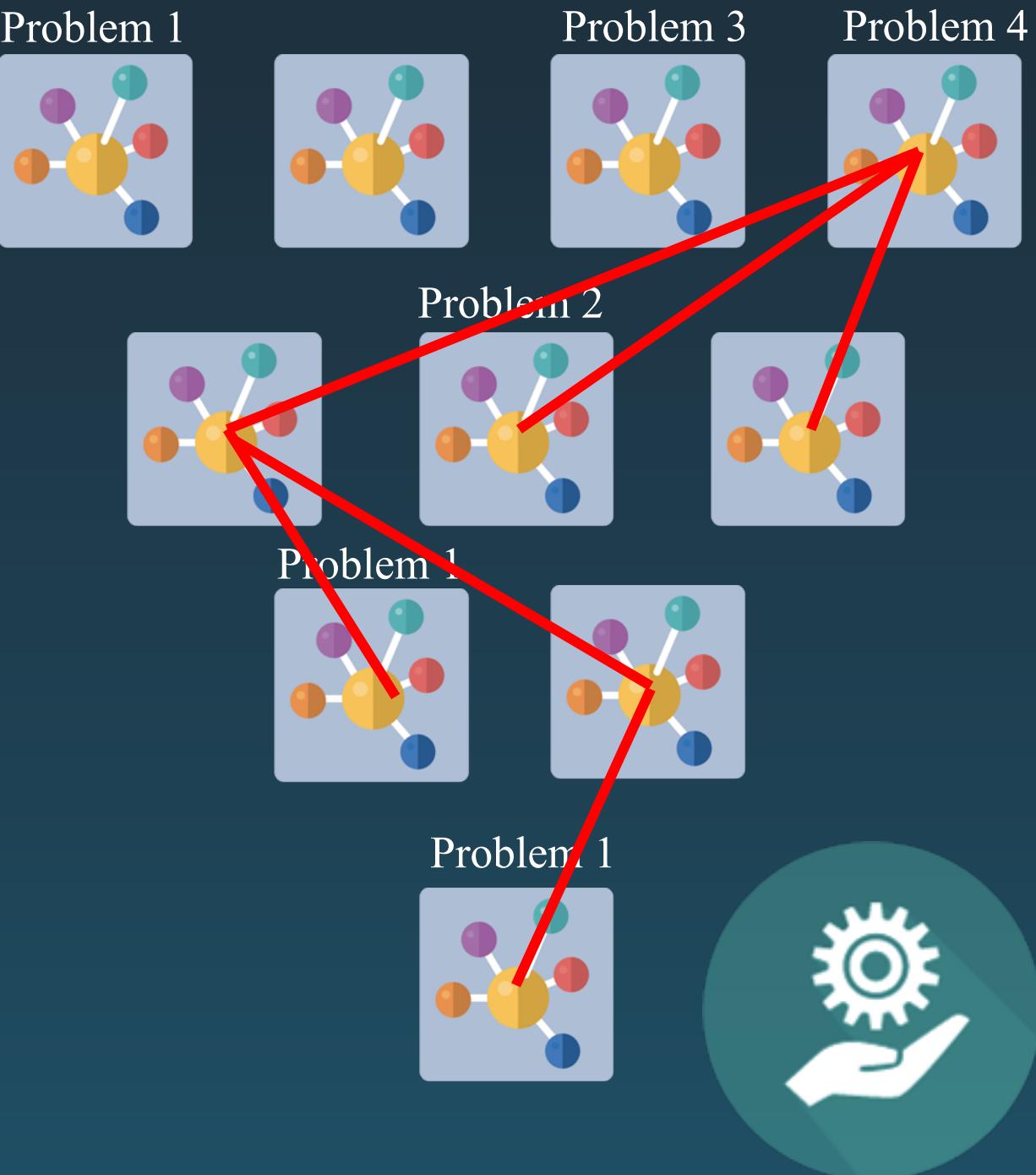
# Unsupervised Learning



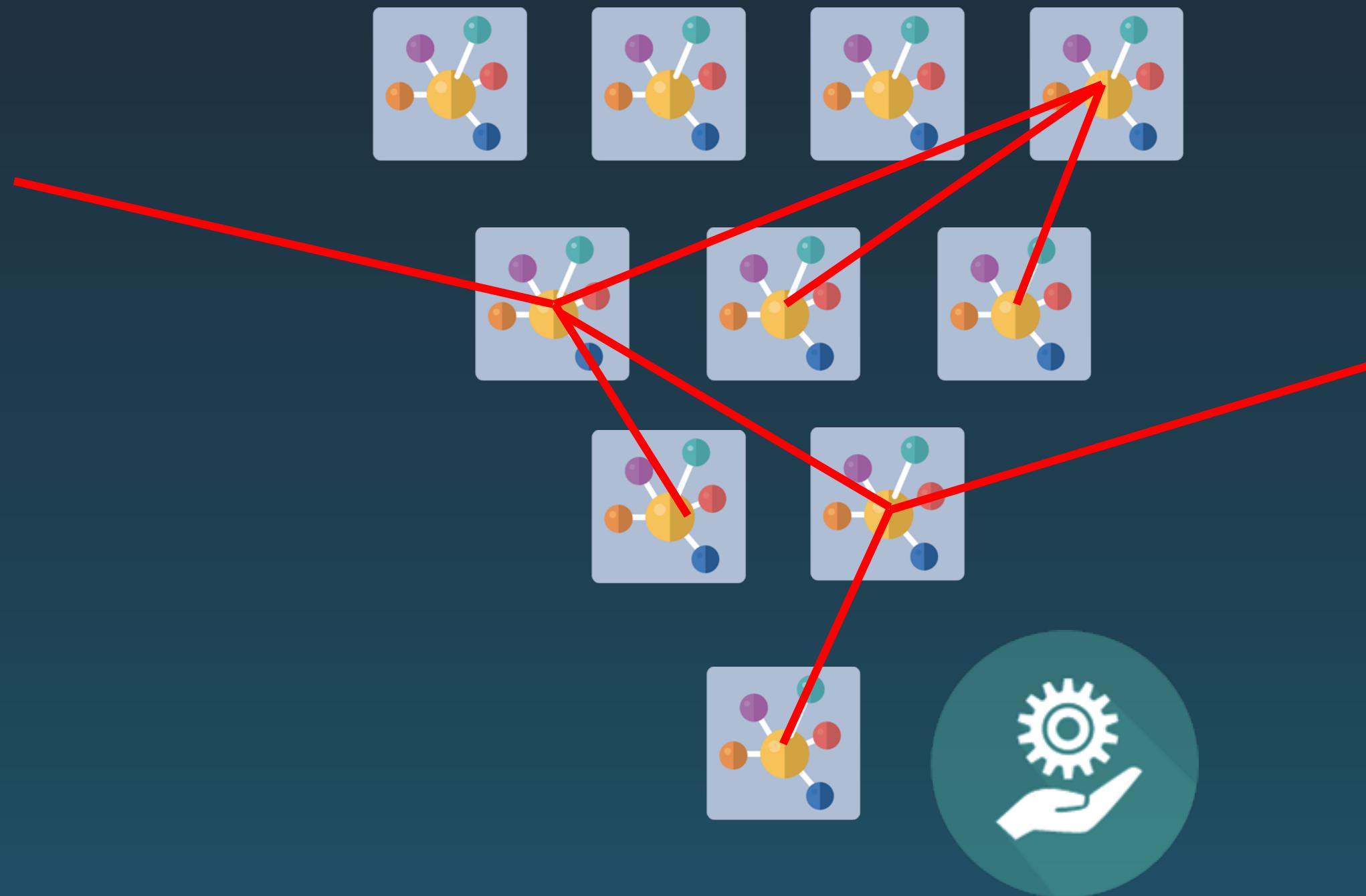
# Supervised Learning



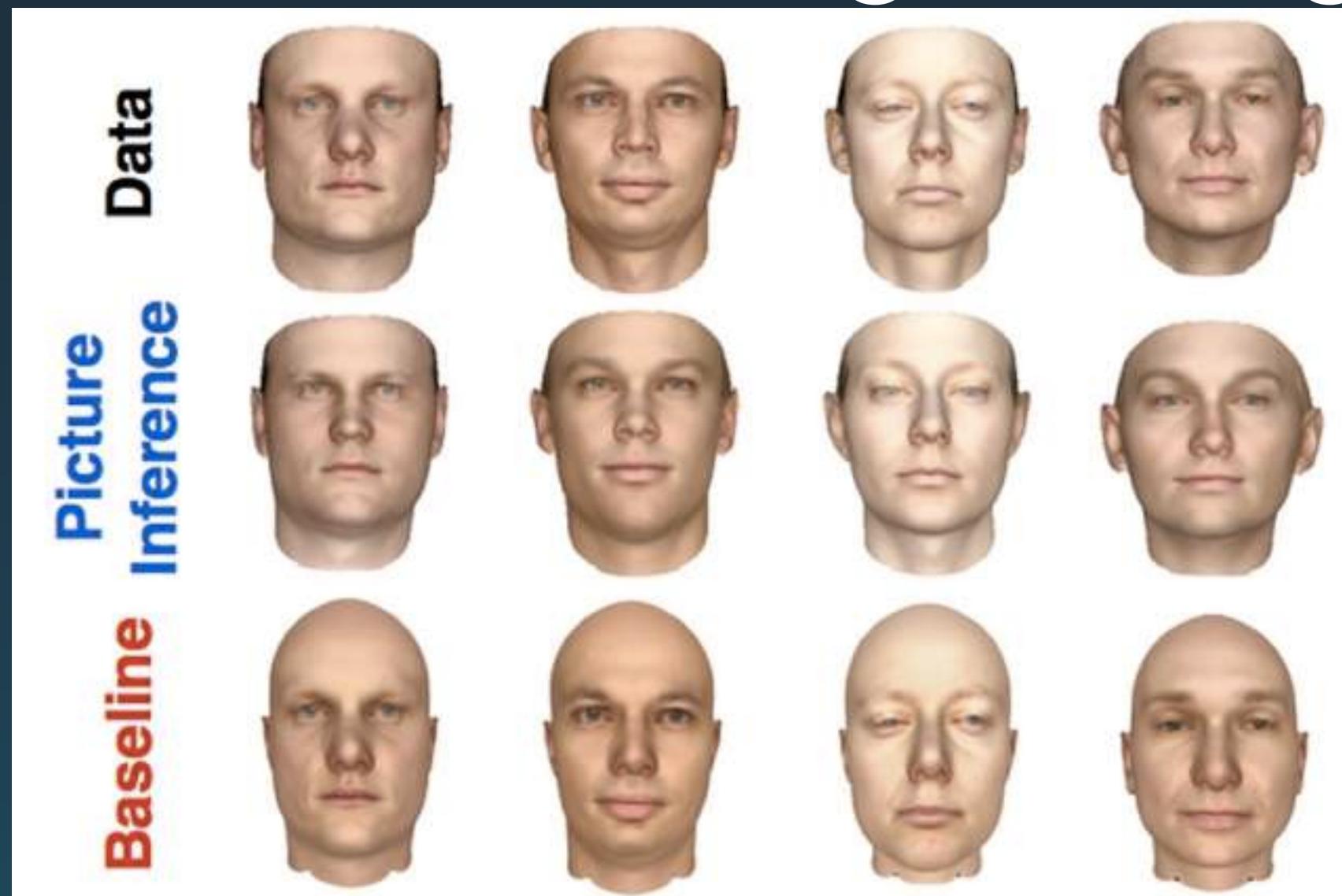
# Semi-Supervised Learning



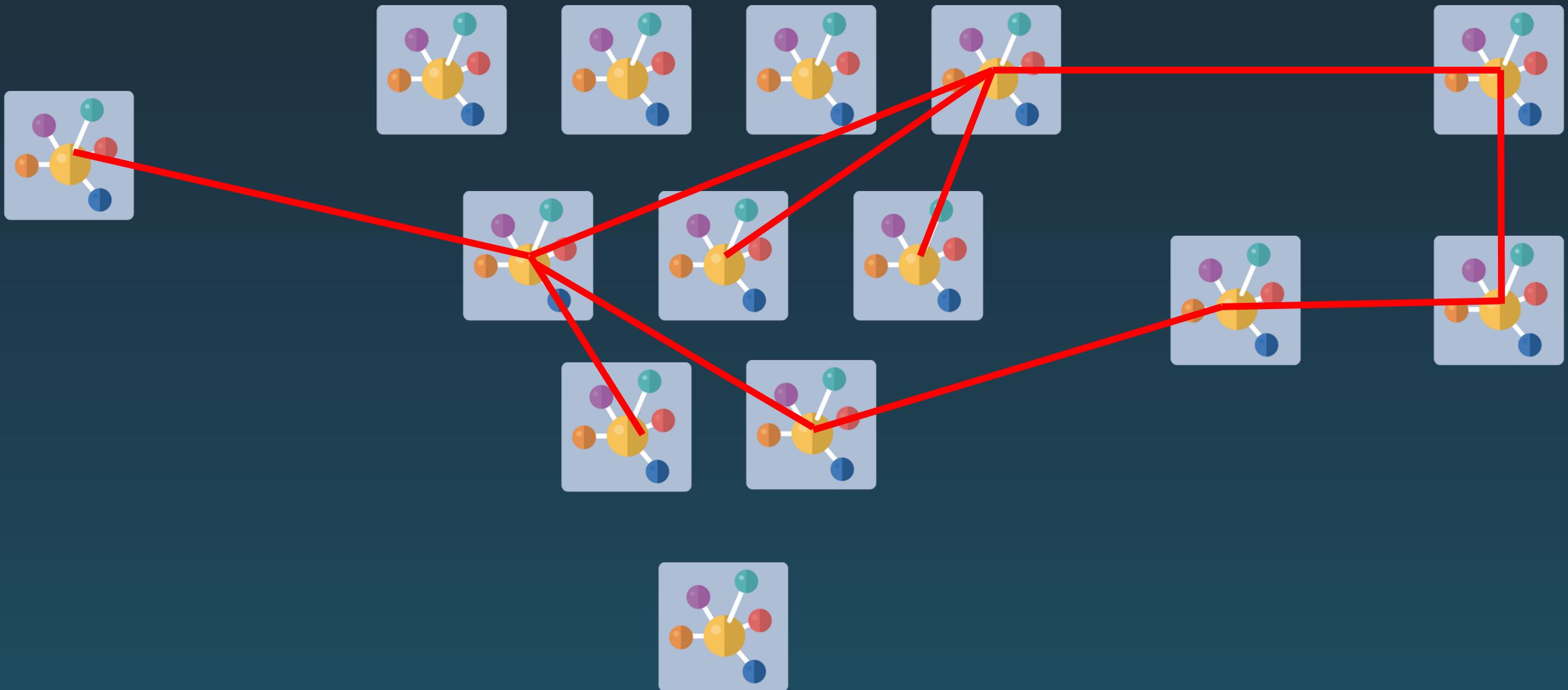
# Clustering and retrieval



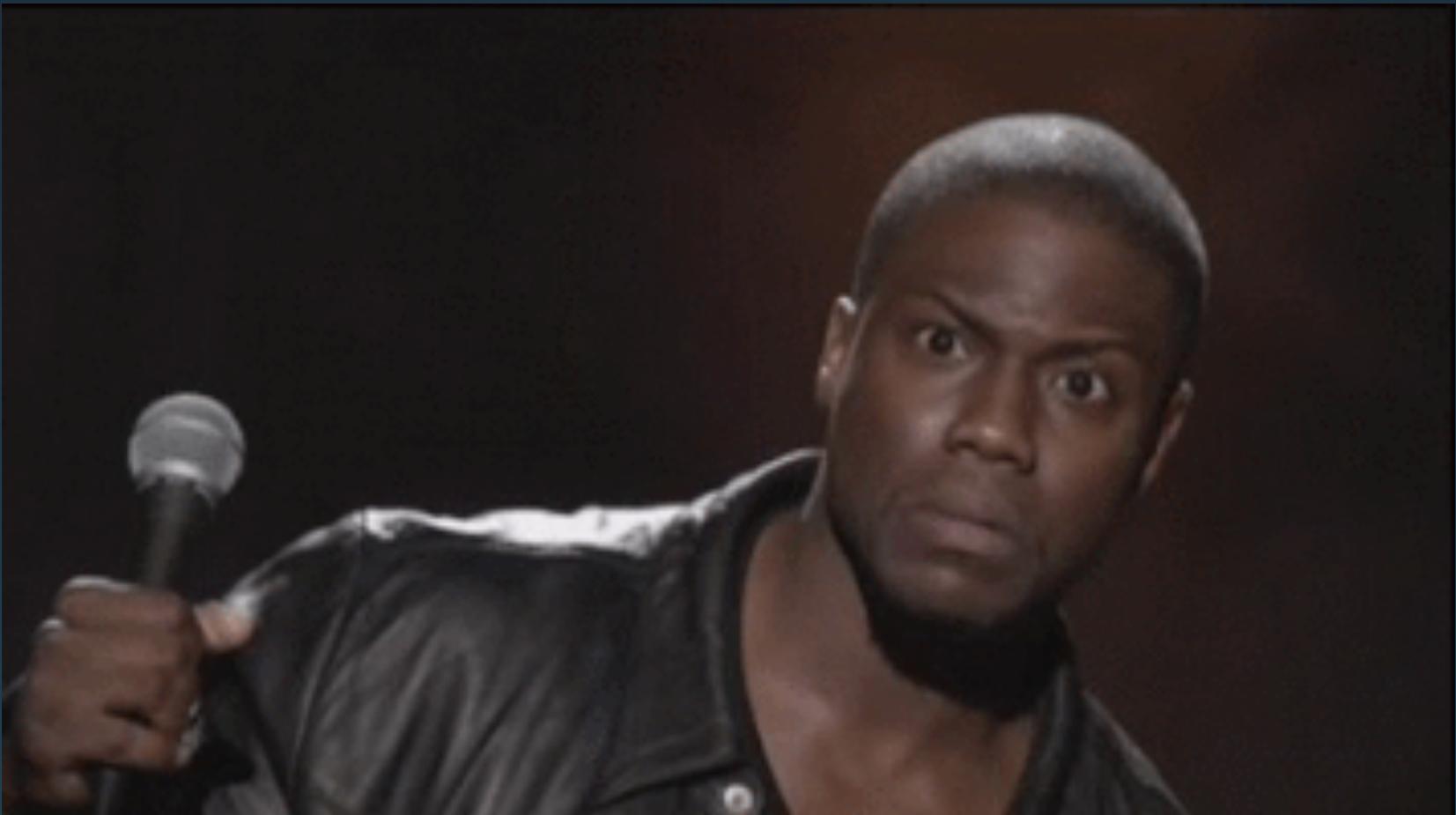
# Probabilistic Programming



# Probabilistic Machine Learning



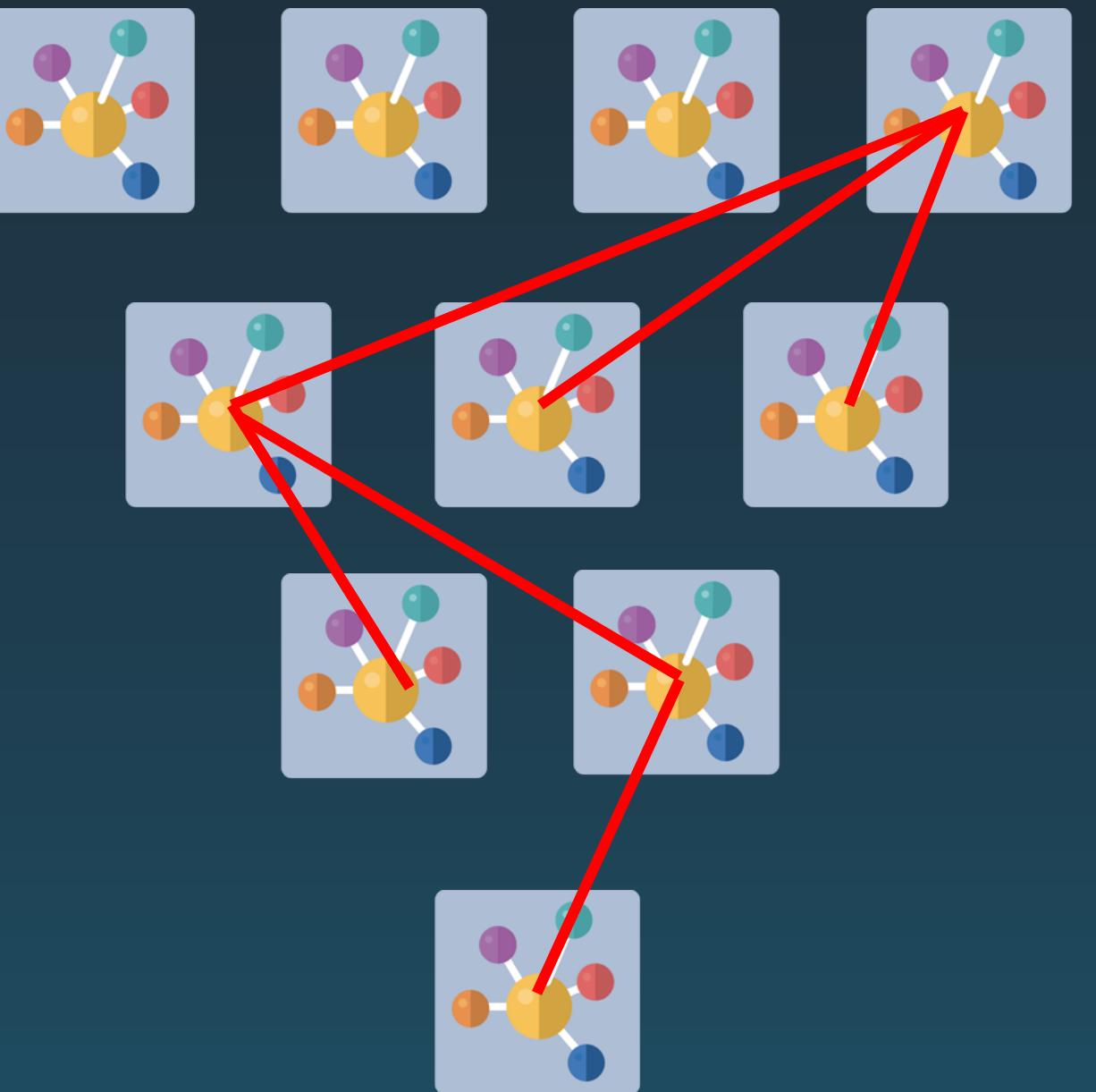
Say what....



# Applying to API use



# Logging Learning



# Get Requests

Response Code: **404 NotFound**

Request URL:

```
GET /api.xro/2.0/invoices/07f29d77-16ca-48ab-a785-d8ef8dee335d
```

Request (0 bytes):



```
[REDACTED]
```

Response (47 bytes):

```
The resource you're looking for cannot be found
```



# Data Formatting

Response Code: **400 BadRequest**

Request URL:  
PUT /api.xro/2.0/invoices

Request (548 bytes):

```
<Invoices>
<Invoice>
<Type>ACCREC</Type>
<Contact>
<Name>Martin Hudson</Name>
</Contact>
<Date>2016-10-05T00:00:00</Date>
<DueDate>2016-10-12T00:00:00</DueDate>
<LineAmountTypes>Exclusive</LineAmountTypes>
<LineItems>
<LineItem>
<Description>Monthly rental for property at 56a Wilkins Avenue</Description>
<Quantity>4.3400</Quantity>
<UnitAmount>395.00</UnitAmount>
</LineItem>
</LineItems>
</Invoice>
</Invoices>
```

Response (1,477 bytes):

```
<ApiException xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
<ErrorNumber>10</ErrorNumber>
<Type>ValidationException</Type>
<Message>A validation exception occurred</Message>
<Elements>
<DataContractBase xsi:type="Invoice">
<ValidationErrors>
<ValidationError>
<Message>The date 10/5/0016 is not valid</Message>
</ValidationError>
</ValidationErrors>
<Contact>
<ContactID>8ffc9aab-34c5-4fa6-970a-c3972459563d</ContactID>
<Name>Martin Hudson</Name>
</Contact>
</DataContractBase>
</Elements>
</ApiException>
```



# Functional System Interaction and

Response Code: **400 BadRequest**

Request URL:  
POST /payroll.xro/1.0/LeaveApplications

Request (339 bytes):

```
<LeaveApplications>
    <LeaveApplication>
        <EmployeeID>d99b5523-e123-4531-95b9-434149abb328</EmployeeID>
        <LeaveTypeID>46c13ace-16cb-489a-8900-d0a74a3e351a</LeaveTypeID>
        <Title>Planning vacation </Title>
        <StartDate>2017-07-02</StartDate>
        <EndDate>2017-07-16</EndDate>
    </LeaveApplication>
</LeaveApplications>
```

Response (561 bytes):

```
{"Id":"7c6ba630-b2f4-4525-b48a-3c43001cb7bd","ProviderName":"ML test app","ErrorNumber":10,"Type":"ValidationException","Message":"A validation exception occurred","LeaveApplications":[{"ValidationErrors":[{"Message":"Unable to create leave request. This leave type has to be assigned to this employee to create and process a leave request."}],"EmployeeID":"daaa5523-e123-4531-95b9-4341490bb328","LeaveTypeID":"46aa3ace-16cb-489a-8900-d0274a3e351a","Title":"Planning vacation","StartDate":"/Date(1498953600000+0000)/","EndDate":"/Date(1500163200000+0000)"}]}
```



# Benefits



# Less platform load



# Better understanding of usability



# More versatile requests



# New API types



imgflip.com



# User machine learning threshold



# Extending functionality

PUT

[Clear Input](#) [Insert Full Xml](#) [Insert Minimum Xml](#)

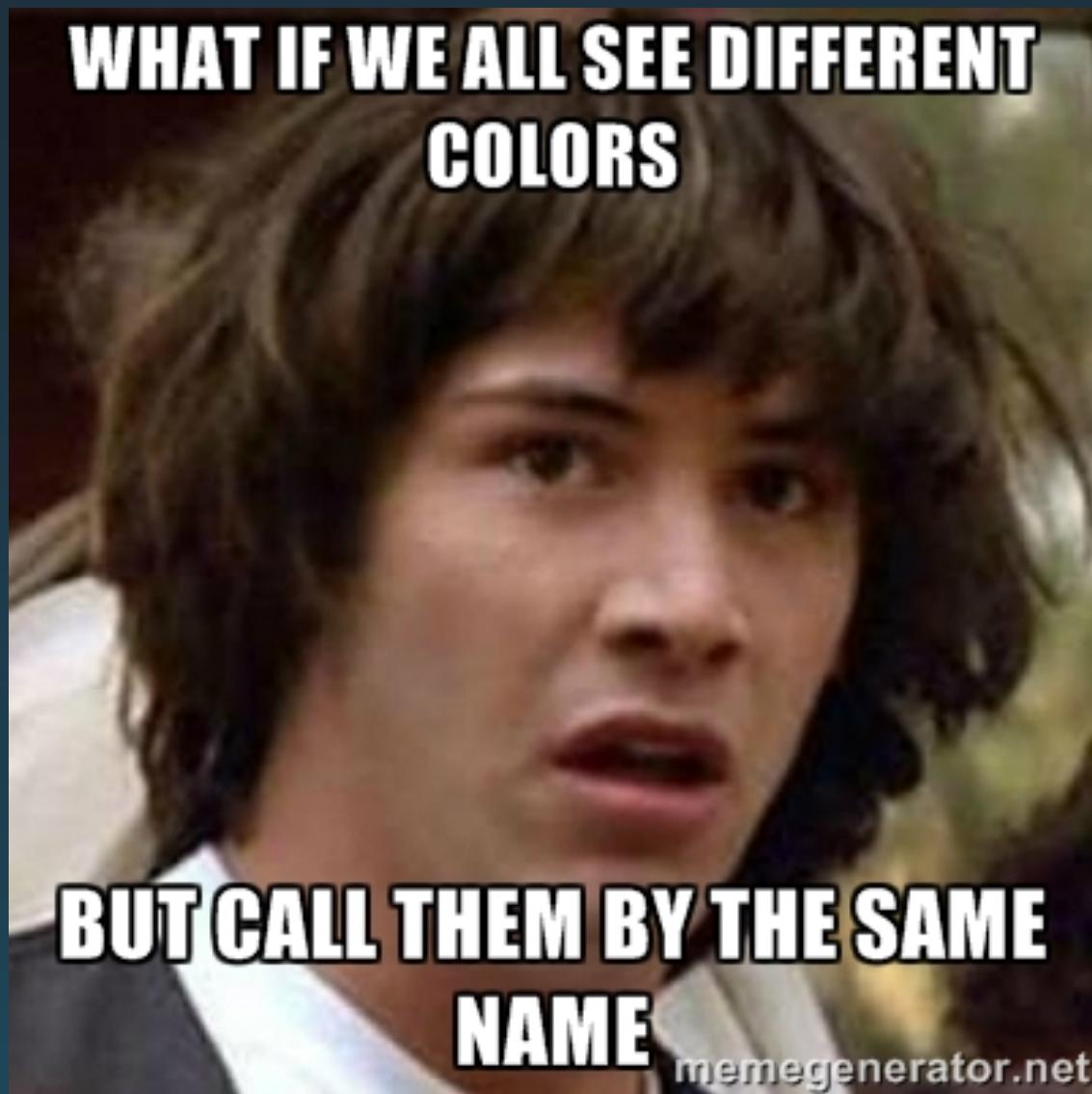
```
1 <Invoices>
2   <Invoice>
3     <Type>ACCREC</Type>
4     <Contact>
5       <Name>Martin Hudson</Name>
6     </Contact>
7     <Date>2016-10-05T00:00:00</Date>
8     <DueDate>2016-10-12T00:00:00</DueDate>
9     <LineAmountTypes>Exclusive</LineAmountTypes>
10    <LineItems>
11      <LineItem>
12        <Description>Monthly rental for property at 56a Wilkins Avenue</Description>
13        <Quantity>4.3400</Quantity>
14        <UnitAmount>395.00</UnitAmount>
--
```

[Run](#)



# Challenges

# API's are organisationally different



# API's are used differently



# Query time + Machine Learning latency



# Training the dataset



# Local Testing

# NGINX



# OpenRESTY

The screenshot shows the homepage of the OpenResty website. The header features the OpenResty logo (a green stylized bird) and the text "OpenResty™ Scalable Web Platform by Extending NGINX with Lua". Below the header, a green banner contains the text "OpenResty is a dynamic web platform based on NGINX and LuaJIT." and "It's open-source stuff so you can contribute:". To the right of this text is a button with the GitHub logo and the text "Contribute on GitHub »". The main content area has a sidebar with links: "Getting Started", "Download", "Installation", "Upgrading", and "Changes". The main content area also features a large "OpenResty" title and a detailed description of the platform's capabilities.

**OpenResty**

OpenResty™ is a full-fledged web platform by integrating the standard core, [LuaJIT](#), many carefully written Lua libraries, lots of high quality [third-party Nginx modules](#), and most of their external dependencies. It is designed to help developers easily build scalable web applications, web services, and dynamic web gateways.

[Getting Started](#)

[Download](#)

[Installation](#)

[Upgrading](#)

[Changes](#)

# TORCH

A SCIENTIFIC COMPUTING FRAMEWORK FOR LUAJIT

## What is Torch? #

Torch is a scientific computing framework with wide support for machine learning algorithms that puts GPUs first. It is easy to use and efficient, thanks to an easy and fast scripting language, LuAJIT, and an underlying C/CUDA implementation.

A summary of core features:

- a powerful N-dimensional array
- lots of routines for indexing, slicing, transposing, ...

# Jemsoft

The image shows a tablet screen displaying the Jemsoft website. The website has a dark orange header with the Jemsoft logo on the left and navigation links for Home, Enterprise, MonocularAPI, and Media Intelligence Co. on the right. The main content area features a large, semi-transparent white text overlay that reads "Robust Computer Vision Solutions for Any Industry". Below this text, there is a blurred background image of an office or industrial setting with people and equipment. At the bottom of the page, there is a footer with links for About Us, Contact, Blog, Press, Careers, and Privacy Policy. On the right side of the footer, there is a small purple cartoon character and the text "Have a great idea? Use our API!". The tablet is set against a dark blue background.



# Questions?



# Xero Dev TV



# xero.com/about/careers/

The screenshot shows a tablet displaying the Xero careers website. The top navigation bar includes the Xero logo, 'Beautiful accounting software', 'SMALL BUSINESSES', 'ACCOUNTANTS', 'BOOKKEEPERS', 'MORE', 'LOGIN', 'FREE TRIAL', and a search icon. Below the navigation is a large photo of two smiling people at a desk, with the text 'Love your career' overlaid. A navigation bar at the bottom of the photo includes 'ABOUT', 'CAREERS' (which is highlighted), 'MEDIA', and 'INVESTORS'. Below this is a secondary navigation bar with 'Overview' and 'Openings'. The main content area features the text 'Do beautiful work' and a paragraph about Xero's global presence and opportunities. A small Xero logo is visible in the bottom right corner of the tablet screen.

Beautiful  
accounting  
software

SMALL BUSINESSES ACCOUNTANTS BOOKKEEPERS MORE LOGIN FREE TRIAL

Love your career

ABOUT CAREERS MEDIA INVESTORS

Overview Openings

Do beautiful work

Over 1,400 Xeros do beautiful work right around the world. We're a rapidly growing global company, with endless opportunities for top talent to shine and make a difference. Join us on the journey of helping millions of businesses thrive.





Beautiful accounting software

[www.xero.com](http://www.xero.com)