Does AI mean data vis is dead?
Does AI mean data visualization is dead?

A discussion on the impact of AI on enterprise business analytics tools such as IBM Cognos Analytics

Anne Stevens
Jamie Waese
Afrooz Samaei

TorCHI
29 January, 2020
Who are we?

User experience designers on the IBM Cognos Analytics product team.

Anne Stevens  Jamie Waese  Afrooz Samaei
Outline

• **Introduction**

• What is the impact of AI as it relates to business intelligence tools?

• Lively conversation
Your task

- Things you question or don’t agree with
- Things that resonate positively with you
Visualization and AI

**AI** is being used here as a collective name for all computer algorithms that (from a human perspective) appear to perform 'higher level analysis' independently.

**Visualization** assists humans in understanding the context of a higher level (sub)task.

Modern computer systems can replace increasingly complex human subtasks with automated equivalents, which removes the human from the task.

As we add more automation, are we decreasing the need for visualization of that task's context?
Visualization and AI at IEEE Vis

Visualization has been used to understand tasks at all level of complexity:

- Helping researchers to see inside their algorithms (e.g. VisxAi)
- Helping data scientists understand the limits of their models.
- Helping everyday users with their genre

We are interested in what amount of visualization is still needed for users having limited exposure to models and AI.

Automation pushes this border up
Business users

Previously, we could count on experienced analytics users, who often have the product name in their job title.

Business users are looking for a quick way to get answers to their questions and see insights in their data.
IBM Cognos Analytics

Cognos Analytics is IBM's flagship Business Intelligence product providing

• Dashboarding
• Reporting (hifi print output)
• On-the-fly data ingestion and modeling
• AI natural language assistance
• Full Enterprise Capabilities

We have made significant investments in automated data analysis.
Model based capabilities: Advanced Forecasting

- **Source of Request**
- **Count**
- **Repeat (column)**
- **Repeat (row)**
- **Local filters**

Indicates a required field.

Drag and drop data to the slots above to build and filter the visualization.
Model based capabilities: Overview of field relationships

Explore data relationships

Boston 311 calls

Days to Resolution

Reset to original

Edit diagram

Select single or multiple nodes to see visualizations.

10% 100%
Model based capabilities: Driver Analysis

The combination of Police District, City Council District and Ward Number is a predictor of Neighborhood

Predictive strength: 85%
Model based capabilities: Decision Tree Analysis
Model based capabilities: Analysis of Meaningful Differences
NLP based capabilities: Conversational Interaction

For Boston 311 calls, here is a list of relevant fields and some basic information about them:

<table>
<thead>
<tr>
<th>Columns</th>
<th>Concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days to Resolution</td>
<td>Continuous, HasOutlier, LowValueRepetition, Duration</td>
</tr>
<tr>
<td>Wind Speed (mph)</td>
<td>Continuous, HasOutlier, Speed</td>
</tr>
<tr>
<td>On-Time Status</td>
<td>Categorical, Nominal, Status, Entity, Identifier</td>
</tr>
<tr>
<td>Temperature (F)</td>
<td>Continuous, Cumulative, Temperature</td>
</tr>
<tr>
<td>Precinct</td>
<td>Categorical, PositiveValue, Measure</td>
</tr>
<tr>
<td>Case Status</td>
<td>Categorical, Nominal, Status, Entity, Identifier</td>
</tr>
<tr>
<td>Wind Gust (mph)</td>
<td>Continuous, HasOutlier, PositiveValue, Measure</td>
</tr>
</tbody>
</table>
Outline

• Introduction

• What is the impact of AI as it relates to business intelligence tools?

• Lively conversation
What is the impact of AI as it relates to business intelligence tools?
Show of hands

Would you describe yourself as a...

- Designer
- Engineer/developer
- Data scientist
- Something else
Your experience with AI is...

- Low
- Medium
- High
Why did we undertake this research?

- Tap into the collective wisdom of IBMers
- Capture snapshot in time
- AI is a rapidly evolving field.
- What is top of mind in 2019?
- Understand areas convergence and divergence
- Capture areas of convergence, as well as critical areas of disagreement that we need to keep our eyes on.
- Identify areas that are most actionable
- Especially for practitioners in the field today
## 15 semi-structured interviews with IBMers

<table>
<thead>
<tr>
<th>Roles</th>
<th>Backgrounds</th>
<th>Education levels</th>
<th>Geographies</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Designers (5)</td>
<td>- Software</td>
<td>- PhD (4)</td>
<td>- USA (7)</td>
</tr>
<tr>
<td>- Developers, system architects (4)</td>
<td>- Computer systems</td>
<td>- Masters degree or graduate certificate (6)</td>
<td>- Canada (5)</td>
</tr>
<tr>
<td>- Researchers (3)</td>
<td>- Industrial and mechanical engineering</td>
<td>- Bachelors degree or undergraduate certificate (5)</td>
<td>- Netherlands (1)</td>
</tr>
<tr>
<td>- Sales and product offering (2)</td>
<td>- Accounting</td>
<td></td>
<td>- Israel (1)</td>
</tr>
<tr>
<td>- Developer and designer (1)</td>
<td>- Journalism</td>
<td></td>
<td>- Germany (1)</td>
</tr>
<tr>
<td></td>
<td>- Data science</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Graphic design</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Biology and health sciences</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Architecture</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Computer animation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Ice breaker question

“It might be tempting to think that the relationship between AI and datavis is that to the extent that AI development succeeds, datavis will become irrelevant. After all, will we need a speedometer to visualize how fast a car is going when it’s driving itself?”

Nicolas Kruchten, VP of Product, Plotly
*Data Visualization for Artificial Intelligence*, Medium, March 13, 2018
Do you need a speedometer in a self driving car?
Do you need a speedometer in a self driving car?

- Not really
- Hell yes!
Do you need a speedometer in a self driving car?

Not really

I don’t need one in an elevator, why in a car?

Speedometer no; dashboard yes

Hell yes!
Do you need a speedometer in a self driving car?

Not really

I don’t need one in an elevator, why in a car?

Speedometer no; dashboard yes

I will never trust the AI 100%

It gives me a sense of control

I’m inherently curious
Do you need a speedometer in a self driving car?

Not really

I don’t need one in an elevator, why in a car?  
Speedometer no; dashboard yes

Hell yes!

Could encounter situations not trained for

I will never trust the AI 100%

It gives me a sense of control

I’m inherently curious

Everything man made breaks

Tells me things are working as they should

I need to know when to take over (or jump)

I don’t need one in an elevator, why in a car?

Speedometer no; dashboard yes

I will never trust the AI 100%

It gives me a sense of control

I’m inherently curious

Everything man made breaks

Tells me things are working as they should

I need to know when to take over (or jump)
Emergent themes

<table>
<thead>
<tr>
<th>How AI is transforming the field of data visualization</th>
<th>How AI is transforming the role of the user?</th>
<th>Challenges of implementing AI features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Or maybe not</td>
<td>Expert user</td>
<td>Reports from the battle front</td>
</tr>
<tr>
<td></td>
<td>Non expert user</td>
<td></td>
</tr>
</tbody>
</table>
Does AI transform data visualization?
Does AI transform data visualization?

No, not really

Yes, absolutely

"Training is never over." - Developer

"When it comes to visualizations, it's subjective. Anne might say this visualization is terrific. Someone else might hate it." - Developer

© 2020 IBM Corporation
Does AI transform data visualization?

No, not really

- Chart primitives, perception endure
- All the heavy lifting is still under the hood
- Visualization needed for context & trust

Yes, absolutely
Does AI transform data visualization?

No, not really

- Chart primitives, perception endure
- All the heavy lifting is still under the hood
- Visualization needed for context & trust

Yes, absolutely

"Training is never over."
- Developer

"When it comes to visualizations, it's subjective. Anne might say this visualization is terrific. Someone else might hate it."
- Developer

"Yes, absolutely"

"Human perception doesn't change because of AI"
"I do not have the impression that people want less information."
- Researcher
All the analytics heavy lifting is still under the hood

The charts will always exist. AI just changes the inputs and outputs. The difference is under the hood. The AI generated data is great, but the charts are still pretty mundane.

- Developer/Architect
Does AI transform data visualization?

No, not really

Chart primitives, perception endure

All the heavy lifting is still under the hood

Visualization needed for context & trust

Yes, absolutely

“**I don't see how anybody will trust AI just on its own without visualization; without feedback.** If you look around at all the recent articles, they're all about removing bias. It's about trust. How can I ensure this model isn't discriminating against women or men. The only way to overcome that is to visualize; to see it.

- Developer
Does AI transform data visualization?

No, not really

- Chart primitives, perception endure
- All the heavy lifting is still under the hood

Yes, absolutely

- Visualization needed for context & trust
- AI outputs
- AI processes
Does AI transform data visualization?

No, not really

Chart primitives, perception endure

All the heavy lifting is still under the hood

Visualization needed for context & trust

Yes, absolutely

AI outputs

AI processes

Automation means there’s less to visualize

Get out of the data weeds

Uncertainty, data quality

"Maybe right now you have an understanding from dashboards of inventory or purchases … some of that goes away because the system automates it. Once we rely more on AI, and it is trustworthy, then there's less to monitor. … It goes back to trust."

- Designer
Does AI transform data visualization?

- No, not really
  - Chart primitives, perception endure
  - All the heavy lifting is still under the hood
  - Visualization needed for context & trust

- Yes, absolutely
  - AI outputs
  - AI processes
  - Automation means there's less to visualize
  - Uncertainty, data quality

Get out of the data weeds

“It might change the thing we communicate. We no longer care about speed but we probably care about something else. AI is all about aggregation. Information can make you not play in the weeds but at a higher level.”

- Designer
Does AI transform data visualization?

- No, not really
  - Chart primitives, perception endure
  - All the heavy lifting is still under the hood
  - Visualization needed for context & trust
- Yes, absolutely
  - AI outputs
  - AI processes
  - Uncertainty, data quality

Uncertainty, data quality

“There is an authority with putting dots on a certain place and not somewhere else on a paper ... there is not much you can argue with. There is quite a bit of work on uncertainty in visualization and I don’t think it is a done chapter yet in information visualization. I think there is a lot to do. Many people think DV as a done field. I don’t think so.” - Researcher
Does AI transform data visualization?

- No, not really
  - Chart primitives, perception endure
  - All the heavy lifting is still under the hood
  - Visualization needed for context & trust

- Yes, absolutely
  - AI outputs
    - AI processes
      - Automation means there's less to visualize
      - Get out of the data weeds
      - Uncertainty, data quality
      - Shed light into the 'black box'
      - Visualizations as inputs to AI

- "Training is never over."
  - Developer
  - "When it comes to visualizations, it's subjective. Anne might say this visualization is terrific. Someone else might hate it."
  - Developer

© 2020 IBM Corporation
Does AI transform data visualization?

- Yes, absolutely
  - AI outputs
  - AI processes
  - Shed light into the ‘black box’
  - Visualizations as inputs to AI

- No, not really
  - Chart primitives, perception endure
  - All the heavy lifting is still under the hood
  - Visualization needed for context & trust

"Black boxes are scary. I need to see what are you doing so I can override it if necessary." - Developer

"An AI model can have 300 dimensions of data. People try to visualize that. And that is where data visualization is transformed for the worst." - Designer
Does AI transform data visualization?

No, not really

Chart primitives, perception endure

All the heavy lifting is still under the hood

Visualization needed for context & trust

Yes, absolutely

AI outputs

AI processes

Automation means there's less to visualize

Get out of the data weeds

Uncertainty, data quality

Shed light into the ‘black box’

Visualizations as inputs to AI

“AI is excellent at handling images, so why couldn't data visualizations of data be the input to a machine learning algorithm?”

- Research
Take away
Takeaway

It’s complicated
There is a lot of difference of opinion

Parable of the six blind men and the elephant
Perception is limited and subjective
Emergent themes

How AI is transforming the field of data visualization

Or maybe not

How AI is transforming the role of the user?
- Expert user
- Non expert user

Challenges of implementing AI features

Reports from the battle front
How might AI transform the roles of our users?
How might AI transform the roles of our users?

End user

Domain expert

Data visualization expert
How might AI transform the roles of our users?

End user

Automation reduces analyst role

New data expand analyst role

New skill sets change roles

Domain expert

Data visualization expert
How might AI transform the roles of our users?

End user

Automation reduces analyst role

New data expand analyst role

New skill sets change roles

Domain expert

Data visualization expert

Move up the decision making pyramid

Passive consumer

Future is more about representing the answer or the meaning, not just the data itself. As though it is about removing the noise.”

- Designer
How might AI transform the roles of our users?

Automation reduces analyst role

New data expand analyst role

New skill sets change roles

Move up the decision making pyramid

Executive decision-makers

“In future the jobs would be focused on translating the data patterns to business. Users will not have to be proficient in basic statistical principles. Their role, as the domain expert, will be more about translating insights to a particular business context.”

- Researcher
How might AI transform the roles of our users?

End user
- Automation reduces analyst role
- New data expand analyst role
- New skill sets change roles

Domain expert

Data visualization expert

Passive consumer
- Move up the decision making pyramid

“AI takes a lot of jobs away from the users who need dashboards to do their jobs. They will have to move to some higher-level positions that are not yet automated.”

- System architect
How might AI transform the roles of our users?

End user

Automation reduces analyst role

New data expand analyst role

New skill sets change roles

Move up the decision making pyramid

Passive consumer

Domain expert

Data visualization expert

Analyst role expansion

“In analysis scenario the user defines the pace. In a car, the human is more of an observer. In a business/analysis case, the human is still the pace keeper and in more control. They use AI as an assistant.”

- Research scientist
How might AI transform the roles of our users?

End user

- Automation reduces analyst role
- Move up the decision making pyramid

New data
- expand analyst role

New skill sets
- change roles

New types of analysis are possible

Domain expert

Data visualization expert

“Users will be going after things that we didn't used to do before. For example, we can use sentiment analysis to analyze customer sentiment. Previously, analysts were probably just looking at basic sales data. Same kind of decision; different data.”

- System architect
How might AI transform the roles of our users?

End user

Automation reduces analyst role

New data expand analyst role

New skill sets change roles

Domain expert

Data visualization expert

Move up the decision making pyramid

Passive consumer

New types of analysis are possible

Blended skills

AI savvy users
How might AI transform the roles of our users?

End user

Automation reduces analyst role

New data expand analyst role

New skill sets change roles

Move up the decision making pyramid

Passive consumer

New types of analysis are possible

Blended skills

AI savvy users

Domain expert

Data visualization expert

“In the future, the distinctions between domains might go away and roles might blend. You have to know about biology if you want to do a biology visualization. You might differentiate by level of expertise, but less so by domain.”

- Research scientist
How might AI transform the roles of our users?

- **End user**
  - Automation reduces analyst role
  - Move up the decision making pyramid
  - Passive consumer

- **New data expand analyst role**
  - New types of analysis are possible

- **New skill sets change roles**
  - Blended skills
  - AI savvy users

- **Domain expert**

- **Data visualization expert**

---

**AI savvy users**

“The generation Z worker took Python in their math class as a 14-year-old could write predictive algorithms to work better in their domain; what was previously considered as advanced data science skills.”

- Sales/business consultant
How might AI transform the roles of our users?

End user

Automation reduces analyst role

New data expand analyst role

New skill sets change roles

Move up the decision making pyramid

Passive consumer

New types of analysis are possible

Blended skills

AI savvy users

Domain expert

Data visualization expert
How might AI transform the roles of our users?

End user
- Automation reduces analyst role
- Move up the decision making pyramid
- Passive consumer

Domain expert
- New data expand analyst role
- New types of analysis are possible
- New skill sets change roles
- Blended skills
- AI savvy users
- Becomes model trainer

Data visualization expert

“AI could shift certain roles, but definitely does not eliminate the need for them.”

- Designer
How might AI transform the roles of our users?

End user

Automation reduces analyst role

New data expands analyst role

New skill sets change roles

Move up the decision making pyramid

Passive consumer

New types of analysis are possible

Blended skills

AI savvy users

Domain expert

Become model trainer

Data visualization expert
How might AI transform the roles of our users?

End user
- Automation reduces analyst role
- Move up the decision making pyramid
- Passive consumer

Domain expert
- New data expand analyst role
- New skill sets change roles
- Become model trainer
- Become storyteller

Data visualization expert
- New types of analysis are possible
- Blended skills
- AI savvy users

Storyteller

“Dashboard work would become less time consuming because dashboard tools become better. In that case data visualization will become used for more interesting storytelling work. Data science in conveying AI concepts is very complicated. You want to be able to tell the story of what the models are doing.”

- Designer / Developer
Takeaway
Takeaway

Skill sets of future expert and non-experts

There is an uncertainty around the skill sets of future experts and non-experts.
Emergent themes

How AI is transforming the field of data visualization
Or maybe not

How AI is transforming the role of the user?
Expert user
Non expert user

Challenges of implementing AI features
Reports from the battle front
What are the challenges of implementing AI features in BI tools?
What are the challenges of implementing AI features in BI tools?

Human

Technological
Context

“\textit{A model that optimizes for profit may not consider other factors, such as social profile.}”
- Designer / Developer
What are the challenges of implementing AI features in BI tools?

- Expectation
  - Cultural
  - Human in the loop

- Design

- Human

- Explainability

- Trust

Technological

“People thought the new assistant could do things it was never intended to do. People wanted it to do sensible meaningful things, but it didn't do that right out of the box.”

- Developer
What are the challenges of implementing AI features in BI tools?

- Human
  - Context
  - Design
    - Expectation
  - Explainability
  - Trust
    - Cultural
      - Human in the loop
      - Who’s driving the train?

“A lot of customers just want a faster horse. This doesn’t necessarily drive innovation in the market place.”

- Offering manager
What are the challenges of implementing AI features in BI tools?

Human in the loop

- Design
  - Cultural
    - Who’s driving the train?
- Explainability
- Trust

Technological

Context
- Expectation

Human

“A properly built machine does not require a user in the loop.”
- Developer

“There will be edge cases. A good self driving car model should ask if you want to hit the grandmother or the children.”
- Researcher
What are the challenges of implementing AI features in BI tools?

- Human
  - Context
  - Design
  - Explainability
  - Trust
  - Human in the loop
  - Who’s driving the train?

- Technological

Explainability

“When you disagree with the output you want to see why the model reached the conclusion it did, and most importantly override it.”

- UX Designer
There is a trust spectrum. The first time I use a model it may need to disclose everything. Maybe not the second time because I'm starting to trust it but the third time I need more explanations again.

- Designer
What are the challenges of implementing AI features in BI tools?

- **Human**
  - Context
  - Design
  - Explainability
  - Trust
  - Human in the loop
  - Who's driving the train?

- **Technological**
  - Not enough data
  - Biased data
  - Training
What are the challenges of implementing AI features in BI tools?

Human
- Context
- Design
- Explainability
- Trust

Technological
- Not enough data
- Biased data
- Training

Cultural
- Human in the loop
- Who’s driving the train?

Expectation
- Not enough data

"Our biggest challenge was the vis recommender. Do I have enough samples to train the model? Where do I get the samples? Are they categorized properly and ready to use?"

- Developer
You might make a machine learning model for oncology but cancer knowledge is obsolete every five years. Therefore, we'll never replace cancer diagnosis by humans with machines.”

- System architect
What are the challenges of implementing AI features in BI tools?

**Human**
- Explainability
- Trust
- Human in the loop
- Who's driving the train?
- Cultural
- Design
- Context
- Expectation

**Technological**
- Not enough data
- Biased data

**Training**
- Learning

“Training is never over.”
- Developer

“A recommender system shouldn’t make the same bad recommendation twice.”
- Developer
Take aways
Takeaway 1

Real-world challenges may prove to be the bottleneck for future progress.
Takeaway 2

Human challenges may be easier to solve than technological challenges.
Takeaway 3

Introducing AI features into a mature BI tool is especially complicated.
Wrap up
So what does all this mean for Data Visualization?

AI transforms data visualization
- Or not
- It’s complicated
- Depends on your perspective, and the timeframe you have in sight

AI implementation poses challenges
- Not just technical, but human as well

AI impacts the role of the user
- Both expert and non-expert
- There may be a critical uncertainty about the skill sets of future end users
Q & A
Does a self driving car need a speedometer?

- Yes
- No
Show
of hands

Does AI transform data visualization?
- Yes
- No
When you add AI to a car the role of the driver changes to a passenger. Does something similar happen when you add AI to a data analytics tool?

- Yes
- No
Show of hands

Which challenges are more difficult?

- Human
- Technological
How might AI transform the roles of data analysts?

- (Not really a multiple choice question!)