A New Paradigm for Global Medical Affairs
Demystifying Artificial Intelligence – Practical Applications in Key Medical Affairs Functions

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Head, Global Medical Information & Review, Takeda Pharmaceuticals Oncology

Tarun Mathur
Chief Technology Officer Indegene

Matthew Michelson
CEO Evid Science
Focus Areas (FA) are the priority capabilities that are strategically important for the successful implementation and maintenance of a high impact Medical Affairs organization.

Opportunity to build knowledge and share best practices from industry & external experts

Goal is to support MA organization’s efforts to embrace technology and innovation

Channels – Webinars, Workshop, Training, White Papers
Why Digital?

Growing opportunity for Med Affairs to adopt digital technology and for digital innovation to become a core capability for Medical Affairs

From Insight generation to innovative external engagement

Driven by the expectations of HCPs, Patients and Payers

Understanding of technologies is the need of the hour (ML/AI/NLP)
Learning Objectives

- Introduction to the basic concepts of AI in combination with the review of core concepts and definitions.

- Practical Applications of AI across Medical Affairs

- Brainstorming exercise - based on discussed/learned concepts attendees would be encouraged to:
  - share ideas on possible other applications of AI in Medical Affairs
  - identify challenges and opportunities in implementing AI from their perspective
Before we get started...
Polling Time

Enter Code ON SCREEN

Session Q&A - Menti.com
Where do you think your organization is currently in their digital journey

- Not even started: 0%
- Just begun: 58%
- Fairly mature: 42%
- I have no idea: 0%
From your vantage point which areas are ripe for digital intervention in medical affairs

- Field medical: 6%
- Virtual engagement: 8%
- Medical information: 8%
- Scientific communication: 11%
- Material review: 0%
- Training: 3%
- All of the above: 64%
From your perspective, what is key for digital initiatives to be successful?

- Measurable outcome
- Trial and error
- Money and the right people
- Compliance
- Proper training and implementation
- Leadership mindset to innovate.
- Senior leadership support
- Buy in from the full team
- Culture change.
From your perspective, what is key for digital initiatives to be successful?

- Meeting needs of the audience
- Adoption
- Embrace change
- Informative and speed
- Good KPIs
- People’s willingness to adopt it
- Proper training
- Collaboration with all functions
- Investment
- A clear strategy of what is meant and what to achieve
From your perspective, what is key for digital initiatives to be successful?

- Buy In
- Leadership
- No afraid to do things differently
- Education of end users, top level support and budget
- Resources and regulation
- Adoption
- Good KPIs
- Training
- No clear strategy and focus
From your perspective, what is key for digital initiatives to be successful?

Comparing to old methods

Too many processes, end up not feeling motivated
From your perspective, what is the primary reason some digital initiatives fail?

- Leadership
- Lack of patience
- Lack of buy in
- Lack of participation
- Unwilling to change workflows
- Stuck in their ways
- Value definition
- Lack of resources
- Lack of support
From your perspective, what is the primary reason some digital initiatives fail?

- Lack of buy in
- Lack of budget
- Lack of competence
- Lack of proper funding and lack of implementation support (with patience!)
- Lack of follow-through
- Not enough experience
- Short term thinking
- Poor communication of value to users/stakeholders
- User adoption not understood
From your perspective, what is the primary reason some digital initiatives fail?

- Understanding investment to innovate and possibly fail
- No clear strategy
- Lack of perceived value
- Lack of adoption
- Lack of training
Is there an interesting experience you would like to share with the folks in the room today?

- Yes: 8%
- No: 92%
Where do you think your organization is currently in their digital journey?

- Not even started
- Just begun
- Fairly mature
- I have no idea
From your vantage point which areas are ripe for digital intervention in medical affairs

- Field medical
- Virtual engagement
- Medical information
- Scientific communication
- Material review
- Training
- All of the above
From your perspective, what is key for digital initiatives to be successful?

Free Text Response
From your perspective, what is the primary reason some digital initiatives fail?

Free Text Response
Is there an interesting experience you would like to share with the folks in the room today?

Yes

No
Let’s Play BINGO!

• Cards on your table listing key concepts

• Strike out each concept as you hear about it during the workshop

• Special prize to the first one completing their card
Basic Concepts

Tarun Mathur, Indegene
# Technologies in the AI Landscape

<table>
<thead>
<tr>
<th>NLP</th>
<th>NLG</th>
<th>Machine Vision</th>
<th>Classifiers</th>
</tr>
</thead>
<tbody>
<tr>
<td>◆ Natural Language Processing</td>
<td>◆ Natural Language Generation</td>
<td>◆ Process images &amp; videos</td>
<td>◆ Trained models</td>
</tr>
<tr>
<td>◆ Extract structured information from unstructured text</td>
<td>◆ Generate natural text from structured information sources</td>
<td>◆ Identify and separate objects of interest</td>
<td>◆ Attach meaningful metadata to objects</td>
</tr>
</tbody>
</table>
Applications of AI Technologies in Life Sciences

Customer Experience
- On-Demand Information
- Personalization
- New Channels

Predictive and Prescriptive Analytics
- Segmentation & Clustering
- Next Best Action
- Content & Message Effectiveness

Document & Digital Asset Management and Lifecycle

Process Automation (RPA)
Natural Language Processing

NLP extracts information from free-text into a form that computers can understand.

Unified Medical Language System (UMLS)

- RXNorm
- SNOMED-CT
- NCI Thesaurus
- MeSH
- ICD9

Will run a demonstration of NLP System
NLP – Big Advances & Easier to Implement

- 2013 – Word2Vec
- 2017 – “Attention is All You Need”
- Jan 2019 – TransformerXL
- Jul 2019 – Facebook RoBERTa
- 2014 – GloVe
- 2018 – ULMFiT & BERT
- Jun 2019 – XLNet
- Aug 2019 – Facebook XLM (100 languages)
Natural Language Generation

Generates natural language from structured data

Better Language Models and Their Implications

We’ve trained a large-scale unsupervised language model which generates coherent paragraphs of text, achieves state-of-the-art performance on many language modeling benchmarks, and performs rudimentary reading comprehension, machine translation, question answering, and summarization—all without task-specific training.

Our model, called GPT-2 (a successor to GPT), was trained simply to predict the next word in 40GB of Internet text. Due to our concerns about malicious applications of the technology, we are not releasing the trained model. As an experiment in responsible disclosure, we are instead releasing a much smaller model for researchers to experiment with, as well as a technical paper.
Building Machine Learning Classifiers

- Training Documents
- Feature Extraction
- Machine Learning Algorithm
- Machine Learning Model
- Computable Features
- Annotations

Identify clusters of objects / information across many parameters
Attach to a consistent taxonomy
Human in The Loop

Data → Machine Classifier

High Confidence

Low Confidence

Output
Machine Vision

- Lots of innovation in this space due to self-driving cars, drones, and surveillance
- Also useful on creative assets and documents

**Object Recognition**
- Recognize objects in a photo and label them

**OCR – Optical Character Recognition**
- Convert text that is rendered as graphics into machine readable text
Application in Med Info

- Provide Natural Language Search Functionality on the SRL Documents
- Automate the content updates to the SRL
- Setup and Manage the Global SRL Management Workflows
- Translation of SRLs into local languages
- Answer Queries from source content making the SRL redundant
- Manage and Curate Literature Articles

Consistency ↑  Accuracy ↑  Speed to Market ↑  Process Simplification ↑  Content Redundancy ↓
Automating Content Assembly From Components

Will run a demonstration of modular content automation.
Add CRM Data → Scoring Content Use Case

Will run a demonstration of content scoring
Demystifying AI in Medical Affairs

“Outside-In” Perspectives

Shaji Kalathil, Bristol-Myers Squibb
An explosion of investment powering advancements in AI
AI Beyond Medical Affairs in Pharma... Gaining Momentum...

- Generating novel drug candidates through automated small molecule screening, design and synthesis
- Applying AI algorithms to genomic datasets

- Patient Matching with Clinical Trials to enable faster recruitment
- Process efficiency with RPA
- Safety Signal Detection

- Virtual coaching and rehabilitation solutions for enhancing the patient experience
- Empowering Sales Force with Next Best Actions
- Call Center Automation with Virtual Assistants

- Visual inspection for detecting defects on manufacturing lines

Natural Language Processing
Machine Learning
Robotic Process Automation
Image and Speech Recognition
Fintech – Digital Financial Coach/Advisor
Aerospace – Increasing Fuel Efficiency
Hospitality – Customer Service
Streaming Media –
Leveraging Context to Personalize Services

Different preferences for genre/theme portrayed

SERENDIPITY

Eternal Sunshine of the Spotless Mind

GOOD WILL HUNTING

GROSS HANDEL

ZOOLANDER

ANGER MANAGEMENT

GOOD WILL HUNTING
Applications in Medical Affairs

Shaji Kalathil, BMS
Rahela Penovski, Cognedt
Bill Strickland, Allergan
Georgios Tramontanis, Takeda
Matthew Michelson, Evid Science
Help us prioritize examples

• Medical Information
  • Material review
  • Real World data
  • Medical Insights
  • External expert

• Assign colorful sticky dots to the options you find best
• Quickly assess which options are the most popular
• We will then present the examples in that order
Reimagining Medical Insights through a Digital Innovation Lens...

Collection of Insights with a Digitally Immersive Solution

Real-world evidence could significantly improve healthcare decisions across the health system and ultimately improve patient care
Rob Snider June 10, 2019

Real-world evidence could significantly improve healthcare decisions across the health system and ultimately improve patient care
Sydney Kuo December 11, 2019

Real-world evidence could significantly improve healthcare decisions across the health system and ultimately improve patient care
Samuel Jonas November 1, 2019

Real-world evidence could significantly improve healthcare decisions across the health system and ultimately improve patient care
Theresa Powell October 25, 2019

Insights Trends Powered by Artificial Intelligence

- Trend identification
- Sentiment Analysis

- Continual evaluation of knowledge gaps
- Identification of unmet medical needs and better understanding of clinical practice
AI for translating RWD into valuable RWE

Lesson learned: Things that work well in practice

<table>
<thead>
<tr>
<th>Study Type</th>
<th>NLP</th>
<th>Text mining</th>
<th>ML</th>
<th>DL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disease burden</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Drug utilisation and patterns of use</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Patient-reported outcomes</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Comparative effectiveness research</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Economic evaluations</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
“True” Chatbot Implementation

• Seamless interaction with HCP on first point of interaction:
  • Clearly identify customer type (HCP/ Patient)
  • Understand the question from Category → Topic
  • Select the appropriate standard response

• Biggest Challenges
  • Understanding of the question, diverse ways to ask the same question..
  • Providing answers that can influence treatment must be 100% accurate and error free
Sample workflow of chatbot

INTAKE
- Immediate chat pick up
- Receipt of consent
- Basic Information of HCP (validation)
- Topic identification

RESPONSE
- On Label topic
  - Attempt to reply by guided: a) topic identification b) SPC question
  - Cannot recognize topic/ question
- Off label topic
- Guide to live chat agent
### Application in Medical Review

#### Use of AI and Natural Language
- Perform mundane, routine tasks
- Check for accuracy
- Verify citations
- Flag anomalies for human review

#### Benefits
- Increase Speed of review
- Increased accuracy
- Decrease cost to review (Less FTEs)
- Have highly trained staff focused on more complex tasks

#### Considerations
- Takes time to train AI
- Up front time commitment will decrease efficacies in the short run
- Trust in the technology (errors)
- Best used in predictable situations
AI for Therapy Landscapes and Strategic Planning

Machine Assistance for Results Gathering
Building a competitive landscape in Wet AMD?

- In around 45 seconds, gather results for MABs and Anti-VEGF treatments...
  - Search (PubMed, conferences, etc.)
  - Filter (PICO)
  - Summarize / Aggregate / Analyze
- You (human!) focus on the fun and interesting parts
  - Analysis, explanation, editorialize...
Wet AMD
Wrap-up
Give us feedback…

• Where do you see the greatest opportunity?

• What kind of external experts would you like to hear from?

• What can be the possible webinar topics for the future?
Evaluation Time!

Enter Code on screen
THANK YOU!