Digital technologies from pharmaceutical company’s perspective – Bracco SpA

Alessandro Maiocchi – Innovation hub – Bracco SpA
Digitalization & AI for the Pharma Industry

- What types of AI applications are currently in use in the pharmaceutical industry?
- What tangible results has AI driven in pharma?
- Are there any common trends among these innovation efforts? How could these trends affect the future of pharmaceuticals?

The Pharma Industry Value Chain

Drug Discovery → Drug Development → Manufacturing → Distribution → Sales & Marketing

A study from MIT has found that only 13.8% of drugs successfully pass clinical trials. Furthermore, a company can expect to pay between $161 million to $2 billion for any drug to complete the entire clinical trials process and get FDA approval.

AI in Drug Discovery (1/2)

Machine Learning for Pharmaceutical Discovery and Synthesis Consortium

This group is a collaboration between the pharmaceutical and biotechnology industries and MIT. The goal of the collaborative efforts is to facilitate the design of useful software for the automation of small molecule discovery and synthesis.
**Drug Discovery**: scientific efforts towards the identification of molecules that could potentially be developed into a new drug

**Cyclica** is a biotechnology company that combines biophysics and AI to discover drugs faster, safer, and cheaper. They have partnered with Bayer to create an AI-augmented integrated network of cloud-based technologies.

**Atomwise** developed **AtomNet technology**, a deep learning neural network application for structure-based drug design and discovery.
AI in Drug Development

**Drug Development:** Scientific efforts towards the identification of molecules that could potentially be developed into a new drug

**Clinical Development:** where AI has been used:

a) Identification, screening and engagements of patients for clinical trials (IBM Watson, Brite Health)

b) Optimizing drug dosage at an individual level (CURATE.AI)

c) Drug adherence in clinical trials (AI.CURE)

d) Analyse clinical trial operations (Mc Kinsey’s Quantum Black)
AI in Clinical Applications

Mining Medical Records

*Google Deepmind Health:* Google Deepmind is able to process hundreds of thousands of medical information within minutes. Google is cooperating with the Moorfields Eye Hospital NHS Foundation Trust to improve eye treatment.

*IBM Watson:* IBM Watson Health offer a suite of products and services which help physicians to make more informed and accurate decisions faster and to cull new insights from electronic medical records (EMR).
Extraction of “Invisible” Biomarkers
Radiomics and radiogenomics of prostate cancer

Clayton P. Smith,1,2 Marcin Czarniecki,1 Sherif Mehraliivand,1,3,4 Radka Stoyanova,5 Peter L. Choyke,1 Stephanie Harmon,5 and Baris Turkbey1

Quantitative MRI radiomics in the prediction of molecular classifications of breast cancer subtypes in the TCGA/TCIA data set

Hui Li,1,2, Yiyan Zhu,1,2, Elizabeth S Burnside1, Erich Huang1, Karen Drucker1, Katherine A Hoadley1, Cheng Fan2, Suzanne D Conzen6, Margarita Zakov6, Jose M Nieto6, Elizabeth Sutton5, Gary J Vithana5, Elizabeth Morris5, Charles M Perou1, Yuan Li1,7 and Maryellen L. Giger1

Deep radiomic analysis of MRI related to Alzheimer’s disease

AHMAD CHAMDAD1,2, CHRISTIAN DESROSIERS3, TAMIR NIAZI2

1Department of Radiology, and 2Department of Physiology; Faculty of Medicine, Université de Montréal, Montréal, QC, Canada
3Department of Radiology, and 7Department of Physiology; Faculty of Medicine, Université de Montréal, Montréal, QC, Canada
A.I. + Radiology = Radiomics

Quantification of Imaging Phenotype

## Multiparametric Radiomics Platform

### Online Multiparametric Database

<table>
<thead>
<tr>
<th>Imaging Modality</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lung PET</td>
<td></td>
</tr>
<tr>
<td>Liver CT</td>
<td></td>
</tr>
<tr>
<td>Head Desmoid T1-weighted MR</td>
<td></td>
</tr>
<tr>
<td>Liver T2-weighted MR</td>
<td></td>
</tr>
<tr>
<td>Brain T1-Weighted MR</td>
<td></td>
</tr>
<tr>
<td>Mammogram</td>
<td></td>
</tr>
</tbody>
</table>

### Radiomics Platform

- **Segmentation**
- **Classification**
- **Registration**
- **Feature Extraction**

### Predictions

- Genetic Mutations
- Tumor Phenotype
- Therapy Response
- Patient Prognosis
- Dementia Diagnosis
- Quantitative maps
AI today in Bracco/CDI

Radiomics for Predicting CyberKnife response in acoustic neuroma: a pilot study

Natascha Claudia D’Amico1, Rosa Sicilia1, Ermanno Cordelli2, Isa Bossi Zanetti3, Giancarlo Beltramo1, Deborah Fazzini4, Giuseppe4
1Unit of Computer Systems and Bioinformatics, Department of Engineer
2Joint Laboratory on Precision Medicine and I
3Università Campus Bio-Medico di Roma - Centro Diagnost
Cyberknife Department, Centro Diagnostico Italia
Bracco Imaging S.p.A., Milan,

Grossi Immunity & Ageing 2010, 7(Suppl 1):S3
http://www.immunityageing.com/content/7/1/S3

PROCEEDINGS

Artificial Adaptive Systems and predictive medicine: a revolutionary paradigm shift

Enzo Grossi

A new radiomics approach to predict the evolution of PI-RADS score 3/5 prostate areas in multiparametric MR

N.C. D’Amico, E. Grossi, G. Valbusa, A. Malasavchi, G. Cardone, S. Papa

Centro Diagnostico Italiano, Milan, Italy.
Bracco Imaging S.p.A.
Many fear that robots, A.I., and automation, in general, will take their jobs without alternatives. The same anxieties emerged in healthcare about artificial intelligence taking the place of radiologists, robots surpassing the skills of surgeons, or taking jobs in pharma.

That is not true !!!

Physicians should accept technology understanding and using it continuing to take the final decision about their patients.

Physicians will work more efficiently at the interface with patients, supporting and guiding them towards the fighting against their own disease.