Deep learning with IBM Watson

IBM Watson @ INAF

Eleonora Picca, Data Scientist Squad – IBM Cloud

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Content

Machine and Deep Learning

IBM AI Portfolio

Overview IBM Cloud Pak for Data IBM Power AI IBM Watson Studio IBM Watson Machine Learning AI for AI

Demo

MNIST dataset classification

Machine and Deep learning

Artificial Intelligence

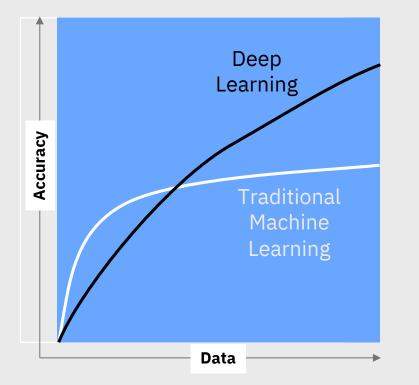
Mimic Humans

Machine Learning

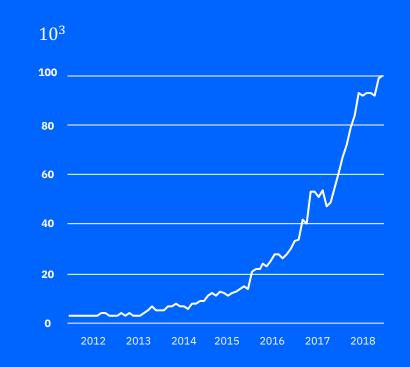
Learn with Experience Deep Learning (Neural Networks)

> Self-Learn with More Data

Deep Learning Has Revolutionized Machine Learning



of Searches for Deep Learning from 2011 to 2017



Source: Google Trends. Search term "Deep Learning"

Data is what fuels digital transformation

> Yet, only **15%** get the value they need from their data ...

And **80%** is locked in silos or not business-ready

AT

There is no AI without an IA

(Information architecture)

do not understand the data required for AI

81%

80%

of data is either inaccessible, untrusted or unanalyzed

66 No amount of AI algorithmic sophistication will overcome a lack of data [architecture] ... bad data is simply paralyzing.



The AI Ladder

A prescriptive approach to accelerating the journey to AI

AI

TRUST – Operationalize AI with trust and transparency

INFUSE – Embed AI into workflow and products at scale

ANALYZE - Scale insights with AI everywhere

ORGANIZE - Create a trusted analytics foundation

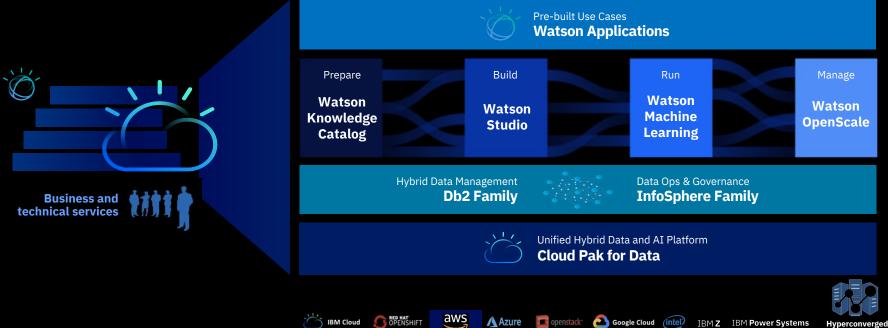
COLLECT - Make data simple and accessible

MODERNIZE your data estate for an AI and multicloud world

Data of every type, regardless of where it lives

The IBM Data and AI Portfolio

Everything you need for enterprise AI, on any cloud



Cloud Pak for Data

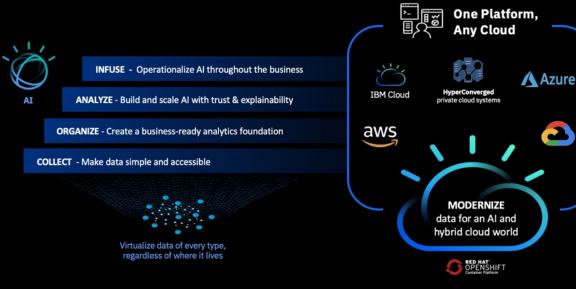
An open and extensible cloud-native platform providing a unified set of data and AI services

Eliminate data silos. connect all data

Automate and govern the data & AI lifecycle

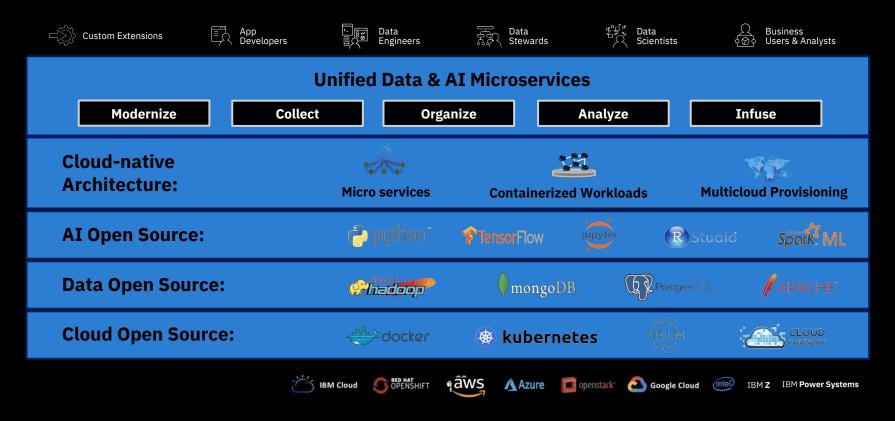
Operationalize AI with trust & transparency

Avoid lock-in, run anywhere with agility



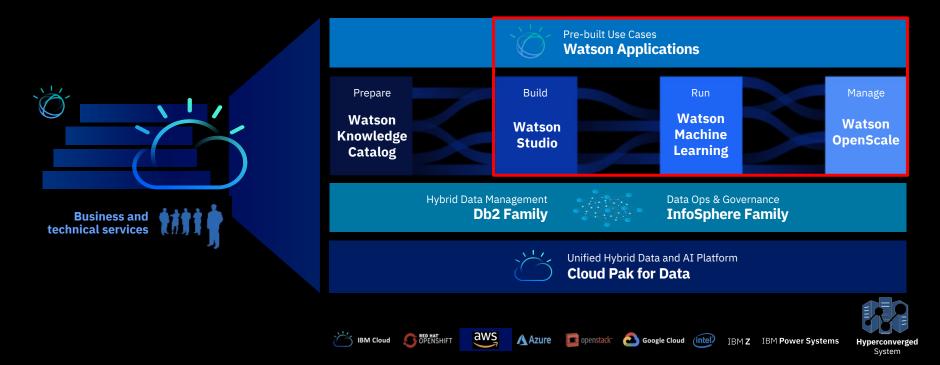
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An open information architecture for AI

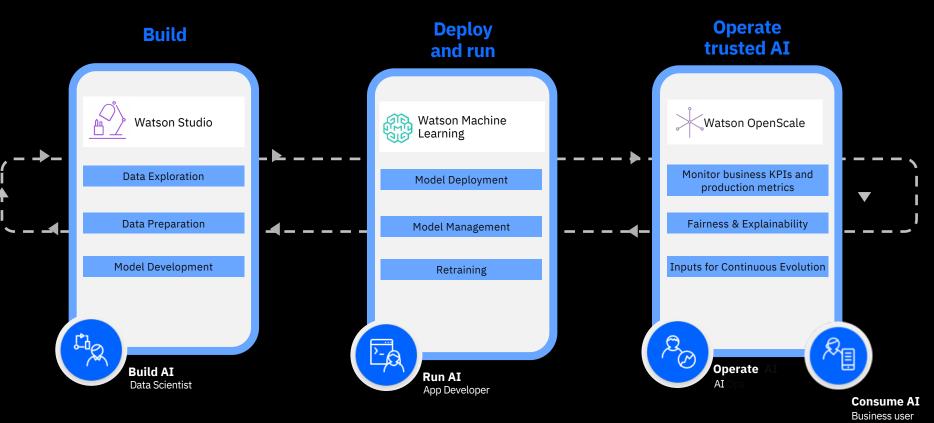


The IBM Data and AI Portfolio

Everything you need for enterprise AI, on any cloud



Watson Studio, WML and Watson OpenScale enables enterprises to operationalize AI



Enterprise Data Science platform that helps your team work together to build models to make better data driven decisions for your business

Analyze any data, no matter where it lives

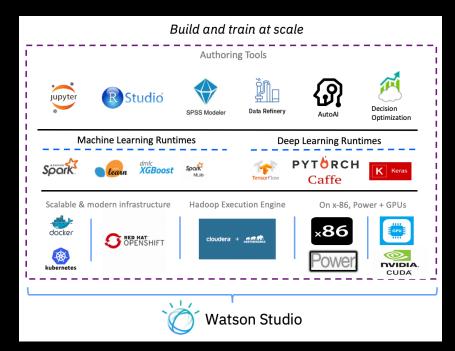
Connect to and analyze your data without moving a single byte through dozens of connectors and multiple deployment options

Empower your entire organization with notebooks, visual productivity, and automation tools

Leverage your entire organization with a variety of tools in a single integrated platform

One platform to rule them all from discovery to production

Analyze data, build predictive models, and seamlessly integrate Watson Machine Learning to deploy at scale



Enterprise Data Science platform that helps your team work together to build models to make better data driven decisions for your business

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Ne	w connection		
IBM	services		
۲	BigInsights HDFS	Ś	Cloud Object Storage
ŵ	Cognos Analytics		Compose for MySQL
iil	Db2 Big SQL	iil	Db2 for i
(\$)	Db2 on Cloud		Db2 Warehouse
IBM	PureData for Analytics		
Thir	d-party services		
٩	Amazon Redshift	٩	Amazon S3
٩.	Dropbox	٩,	FTP
٩	Hortonworks HDFS	0	Looker
٩	Microsoft SQL Server	٩,	MySQL

- IBM Services like Cognos & DB2
- 3rd Party Services like Amazon S3, Hadoop, & Microsoft SQL Server
- We have Public Cloud, Private Cloud, & Desktop/Server deployment options

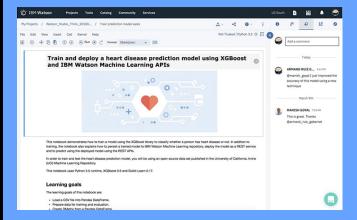
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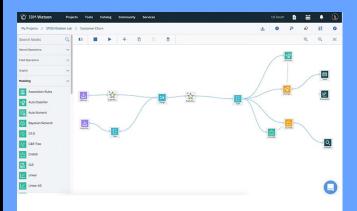
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Super charged Jupyter Notebooks & R Studio as most popular IDEs for data scientists well integrated with data connectors and rich set of default environments



Visual tools such as SPSS Modeler, Data Refinery, & AutoAI for non coders to analyze data and build models

Enterprise Data Science platform that helps your team work together to build models to make better data driven decisions for your business

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One platform to rule them all from discovery to production

Analyze data, build predictive models, and seamlessly integrate Watson Machine Learning to deploy at scale

Seamless integration with:



• Watson Knowledge Catalog brings governance & catalog management



 Watson Machine Learning deploys, manages, & automatically retrains your models



• Watson OpenScale offers unmatched levels of trust in automation

Embed Machine Learning and Deep Learning in your Business

Deploy and Manage Models

Move models to production, in an easy, secure, and compliant way

Intelligent Model Operations

Embed intelligent training services, with feedback loops that constantly learn from new data, regardless where it resides

Accelerate Compute Intensive Workloads

Distribute your deep learning training and Hadoop/Spark workloads with multi-tenant job scheduling

Embe	d ML in you	ır business
	Operationaliz	e
ML/DL Models	Python/R Functions	Data Pipelines Notebooks
	Deployment me	ethods
(api)	Batch	ြို့ Edge
Mar	nagement & Mo	onitoring
Version Control	Lineage	Automation
I		
Wats	son Machi	ne Learning

Embed Machine Learning & Deep Learning in your Business

Deploy and Manage Models

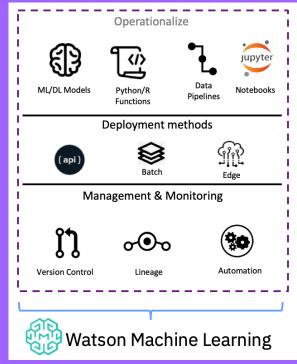
Move models to production, in an easy, secure, and compliant way

Intelligent Model Operations

Embed intelligent training services, with feedback loops that constantly learn from new data, regardless where it resides

Accelerate Compute Intensive Workloads Distribute your deep learning Training and Hadoop/Spark workloads with multi-tenant job scheduling

Flexible deployment capabilities



Embed Machine Learning & Deep Learning in your Business

> **Deploy and Manage Models** Move models to production, in an easy, secure, and compliant way

Intelligent Model Operations

Embed intelligent training services, with feedback loops that constantly learn from new data, regardless where it resides

Accelerate Compute Intensive Workloads Distribute your deep learning Training and Hadoop/Spark workloads with multi-tenant job scheduling



- Configure learning systems
- Flexible management experience
 - User Interface
 - CLI
 - APIs
 - Python SDK

Embed Machine Learning & Deep Learning in your Business

Deploy and Manage Models

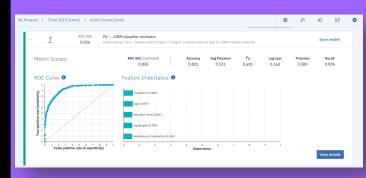
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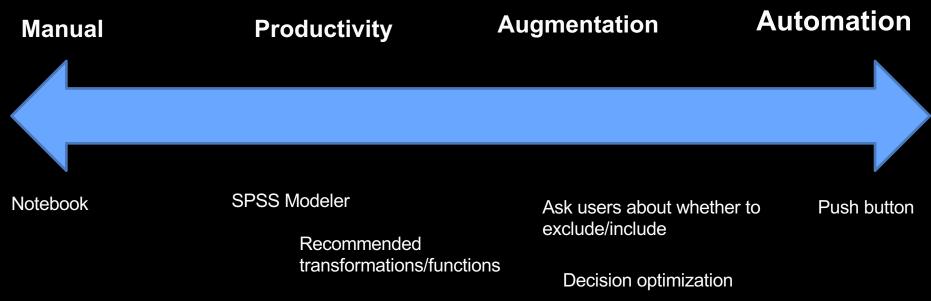


- Visually monitor training jobs
 - Experiments (HPO)
 - AutoAI
- WML Accelerator for optimized Spark and GPU jobs
- Integration with Hadoop for inplace batch training and scoring

AI for AI

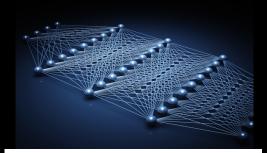
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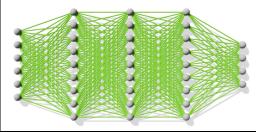
Addressing Data Science Automation-Productivity Spectrum



AI for AI: Automation of AI Development

AI Designing AI





Neural network architecture and search

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AI Optimizing AI



AI Governing AI



Lifecycle management Al pipeline optimization Decision optimization

Monitoring AI outcome with trust and explainability

AI designing AI

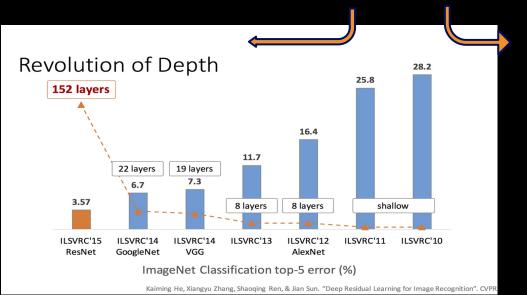
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Design Neural Networks is challenging

Highly skilled researchers/data-scientists are needed to hand-craft custom neural networks

Hand-crafting complex networks is time-consuming, error prone, and does not scale with time and resources

Neural networks continue to grow in size and complexity



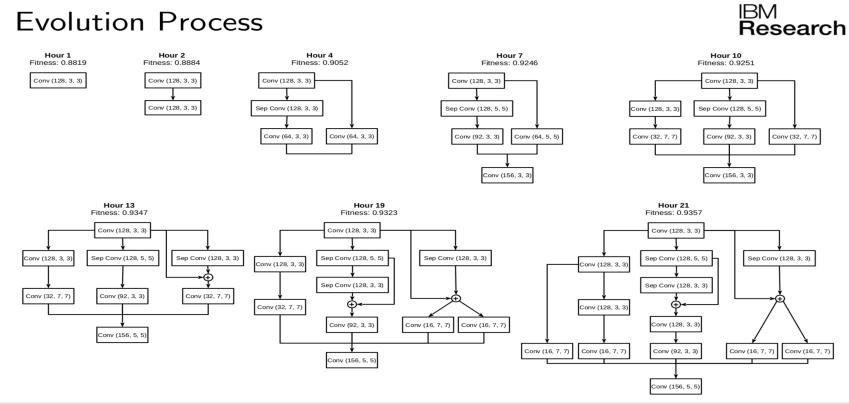
A mostly complete chart of Neural Networks Backfed Input Cell Input Cell Noisy Input Cell Radial Basis Network (RE Percentron (I Feed Forward (FE) fidden Cell Probablistic Hidden Ce Spiking Hidden Cel Output Cell Match Input Output Ce Recurrent Cell Memory Cell Different Memory Cell Kerne Convolution or Por Deconvolutional Network (DN) Deep Convolutional Inverse C e Adversarial Network (GAN) Liquid State Machine (LSM) sidual Network (DRN Vector Machine (SVM

Synthesized Neural Network: A Breakthrough in AI Designing AI

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MNIST	0.15	99.60	-	-	99.7
Fashion MNIST	1.05	92.84	12	95.81	94.0
Cifar-10	1.6	93.67	24	96.42	96.53
Cifar-100	2.1	81.01	24	78.26	82.69
GTSRB	1.55	98.03	-	-	98.45
STL-10	1.55	61.18	-	-	74.33
SVHN	1.55	94.33	12	98.21	98.31

NCEvolve

Evolution Process





What does AutoAI with IBM Watson Studio do?

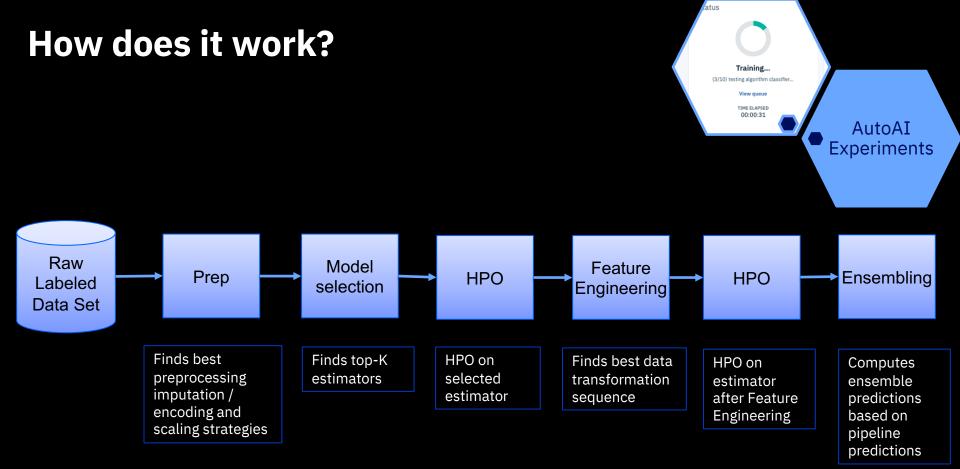
Integrated with **Watson Studio** and **Watson Machine learning**

Automatically ingest, clean, transform, and model with hyperparameter optimization

Training feedback visualizations provide realtime results to see model performance

One-click deployment to Watson Machine Learning

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AI governing AI

IBM Watson OpenScale Automate and Operate AI at Scale

- Trust and Transparency
 - Intelligently delivers bias mitigation help
 - Provides traceability & auditability of AI predictions made in production applications
 - Tracks AI accuracy in applications
 - **Explains** an outcome in business terms
- Automation
 - Automatically detects and mitigates bias in model output, without affecting currently deployed model or outcomes
- Open By Design
 - Monitor and optimize models deployed on third party model serve engines
 - Deploy behind enterprise firewall or on IaaS provider

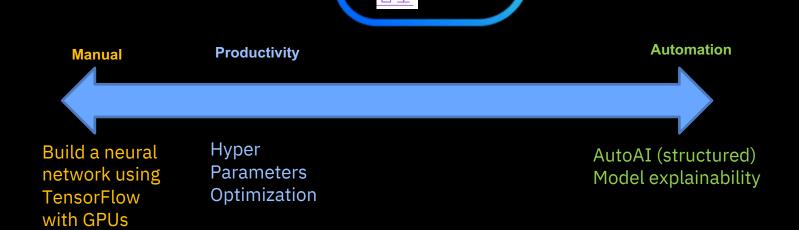
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Demo

MNIST Dataset Classification

The Modified National Institute of Standards and Technology (MNIST) database contains images of handwritten digits with labels. They are 28x28 pixels images.

Lite Version



Thank You

Tutorials and resources

• IBM Cloud

- Create a new free account: <u>https://cloud.ibm.com/registration</u>
- Watson studio documentation: <u>Watson Studio</u>

• Tutorials

- MNIST tutorials: <u>MNIST demos</u>
- AutoAI tutorial: <u>AutoAI tutorial</u>
- OpenScale tutorial: <u>OpenScale Tutorial</u>