From centripetal University of the past to centrifugal *MULTIVERSITY* of the future
(AI and IT education)

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- IT and EDTECH DISRUPTIONS
  - « The 4th paradigm of science » (JIM GRAY, *Turing award in 2006)*
  - *MOOCS and hybrid* « *multiversity* » of the future
  - The AI SKILL tsunamy
  - AI TEACHING in France and Europe

- Bihar master on AI and BIG DATA at ESTIA (France) and its *Network of Digital connected campuses in Africa and their DATA LABs around eBIHAR (Mooc-based European certified master degree)*

  - *IVORY COAST (ESATIC) and MADAGASCAR (ITU) in 2022,*
  - *BENIN in 2023;*
  - *advanced discussions in Morocco, Tunisia, Algeria, Senegal, Gabon, Cameroon, Nigeria,…*

DATUM
ACADEMY

BIG DATA and the « n V »
(DATA : the next big wave)

BIG DATA and the 3 « V »
(M.Stonebraker, Turing award, Proof. Berkeley and MIT)

(for the 3 « P » and the « 3 « R »)

DATA processing : DATA management & DATA analysis

VOLUME
VARIETY
VELOCITY

DATUM
ACADEMY

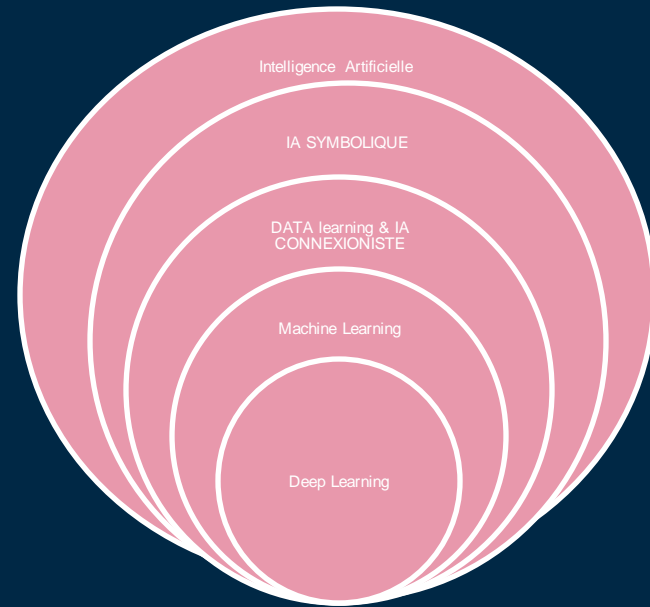# The 4 ages of AI (born in the 50's like computers)

« AI » : 2 underlying scientific disciplines
- AI « SCIENCE » (*Mathematics*, Biosciences)
- **AI « Engineering »** (*Computing* and BIG DATA with last AI revival 10 years ago)
➔ MBDS/eMBDS & BIHAR/eBIHAR Masters

4 AGES of AI (with 2 winters) since 1956 and Mc Carthy definition of ARTIFICIAL INTELLIGENCE
- AGE1 (<2012): **SYMBOLIC AI** (Rules and mathematics)
- AGE2 (with BIG DATA) : **DATA-centrics AI** with Machine learning and promising **DEEP LEARNING** (*Turing award in 2019)*
- **AGE3: SPECIFIC AI from 2022 to 2050)** with *digital twin* on ANY HUMAN ACTIVITY (from cars, health, HR, Agriculture) ➔ **POCs/GRADEOS and Bihar DATA LABS**
to
- AGE4 (>2050) : **GENERIC AI** (*Strong AI*) ??

Intelligence Artificielle

IA SYMBOLIQUE

DATA learning & IA CONNEXIONISTE

Machine Learning

Deep Learning

AI CONCEPTS

Two major e-learning disruptions (MOOCs and SKILLs) amplified by COVID : Towards the « MULTIVERSITY * » of the future with BLENDED learning !

The future of work will be a race between education and technology facing a SKILL crisis!
"

© *The decline of universities and the emergence of HIGHER education"* PAUL GIBBS ("Thinking about higher education" Springer 2014)

© No more frontier between EDUCATION (top down) and LEARNING (bottom up)

From CENTRIPETE universities of the past towards CENTRIFUGAL MULTIVERSITIES of the future !

* (Clark Kerr, Berkeley, 1962)

AI and BIG DATA ... and SKILL demand tsunamy

◎ **World Economic Forum 2020 :** *« From now to 2025, half of active jobs will require up-skilling or re-skilling »!*

◎ **Mckinsey Sept 2018** *« AI will create USD 13 trillion* GDP growth by 2030 most of which in non-Internet Sector »*

◎ Harvard Business Review, Dec 2019, p40) AI will contribute to 13 trillion dollars to the global economy over the next 10 years AI Is colonizing every sector of our economy and society : finance, health, marketing, agriculture, sport, art, press, education, etc.

◎ ACCENTURE, for G20 summit, 2018 " If skill building does not catch up with the rate of technology progress the G20 economy could lose up to 11 trillions US dollars in cumulative GDP Growth in the next 10 years"!
    ◎ *Trillion (10**12; TERA); billion (10**9; GIGA)*

◎ How to accelerate SKILLS acquisition in the age of intelligent knowledge ?

GRADEO

BIHAR* Master of Science on Big Data & Artificial Intelligence and its GRADEOS – ESTIA School of Engineering (Biarritz, France)–

* **« BIHAR »** (*Big data Intelligence for Human Augmented Reality*) means **« TOMORROW »** in Basque Language

A strong fundamental couple :
« BIG DATA and AI »

Two major dimensions of (BIG) DATA PROCESSING

DATA MANAGEMENT
DATA ANALYSIS

Four highly demanded jobs

DATA ENGINEER
DATA SCIENTIST
DATA CLOUD Architect
Big Data Application developer (Web & Mobile)

Two major associated INDUSTRY partnership
(for BIHAR MSc and GRADEOS)

ORACLE
GOOGLE

BIHAR (and eBIHAR) Master of Science on big Data & artificial Intelligence

◎ BIHAR: **face-to face MSc** (12- or 18-month program) at ESTIA, Biarritz (France) with **strong international partnerships**

 ◎ Special **AI track** with University of Siena, Italy (and eBIHAR Moocs in english and french)

 ◎ MOOCs as **complementary** academic resources (for flipped classrooms,..)

 ◎ Innovation projects in the DATA LAB (POCs on industry USE CASES)

 ◎ Master 2 started in Sept. 2020 (Master 1 in Sept.2023 along with Applied AI BACHELOR)

 ◎ International Seminar on AI & BIG DATA (cf DATUM web site)

◎ eBIHAR , MOOC-based version in French and English since 2021 (Master 2) with 90 ECTS

 - CONNECTED DIGITAL CAMPUS (CDCs) and their DATA LABS within an international network in the 5 continents

 - DUAL-DEGREE agreement for the CDC with its university, ESTIA and DATUM ACADEMY

◎ **DATA LAB :** Innovation and Research platform in Big Data & Artificial Intelligence at ESTIA (with ESTIA-TECH support) and in CDC

 ◎ DIGITAL AGRICULTURE, HEALTH, SPORT

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DATA LAB at ESTIA (*learning by doing*)

INNOVATION lab (focus on services and usage of AI and Big Data)

      - Proof of concepts (POCs) and Proofs of value conducted by tutored students and project managers/prof under industry contracts
- ➔ Support for functional gradeos
- ➔ Support for **Learning by doing,**
- ➔ 2022 : <u>Support for the popularization MOOC on AI BY EXAMPLE (« AI360 ») on FUN platform for every student in France in 2023 based upon 6 use cases (ANR grant)</u>

- 3 Key areas of innovation in our DATA LAB
- - **digital agriculture** *(towards a school on digital agriculture with CASAU d EDEN project by Marc Lassus with pilot farms?)*
- - health, smart city/**smart village** (Africa)

DATA LAB at ESTIA with strong Google initial support in oct 2021

◎ **2 EXTRA free professional Google courses on Coursera for BIHAR students** (in French and English) on DATA CLOUD ARCHITECT and DATA ANALYTICS* for BIHAR and gradeos students

  ◎ https://www.coursera.org/professional-certificates/google-data-analytics

  ◎ https://www.coursera.org/professional-certificates/gcp-cloud-architect

◎ in 2022 : **First BIHAR GOOGLE GRADEO** on DATA SCIENTIST in the CLOUD with 1 eBIHAR MOOC (AI) and 1 Google course*

◎ **Google internship on DIGITAL AGRICULTURE in 2022 in our DATA LAB (France and Africa)**

The most successful MOOC on Coursera in 2020 (> 100 000 professional certificates)

Oct the 5th 2021 at ESTIA
Felix Manoharan Director of Higher Education at GOOGLE CLOUD EMEA with P.Elisalde Director of ESTIA

BIHAR

eBIHAR and gradeo dissemination thru « CDC » (Connected Digital Campus) : 3 salient features

- **eLEARNING** *third-place* with **LOCAL FACE-to-FACE TUTORING:** MOOC for every BIHAR Course, GRADEOS   Hybrid/Hyflex LEARNING of the future

      Broadband Internet room

      Flipped classrooms with MOOCS

      Learning by doing INNOVATION (DATA LAB)

- **INNOVATION laboratory** / « **DATA LAB** »/**LIVING LAB for the country** : POCs with local industry and Learning by doing

      © potential start up INCUBATOR

      NOTE : Special popularization FREE MOOC for every student : « AI BY EXAMPLE » (AI360 Mooc)for every student

      around 6 USES CASES/POCS)

INTERNATIONALIZATION : network of CDCs and DATA LABs in 15 Coountries in the 5 continents and first step towards an Institute of AI Engineering

Towards an AI-based TUTORING /MENTORING platform and POC platform

Formal inauguration of the First African Estia/Bihar CDC in Ivory Coast (ESATIC) in March 2022
(French ambassador and two ministers)

Le CAN a été inauguré le 29 mars 2022 en présence de l'Ambassadeur de France (Mr Belliard), de deux Ministres de Côte d'Ivoire, Mr ADOM, Ministre Economie Numérique et Telecom et Mr DIAWARA ministre de l'Enseignement Supérieur et de la Recherche avec P.Elisalde Directeur ESTIA et Pr S.Miranda

Formal CDC opening in July 2022 in Madagascar (IT UNIVERSITY) with great ambition towards *DIGITAL MADAGASCAR in 2023/2024*

Formal agreement with AFRIA and BENIN in 2021 at ESTIA
(CDC in 2023 for French-speaking western African countries)

With Pr ERic Adja, AFRIA president at ESTIA in June 2021
A CDC is opening within AFRIA premisses for BENIN in 2023 for 10 western African Countries (Niger, Burkina, ..)

2 Phases for any BIHAR academic partnership

1) 1) Short term : full DISTRIBUTION of eBIHAR (a European professional certified master 2) and its GRADEOS in the country (with 10 to 30% for the CDC for local tutoring) and DATA LAB creation with the support of Oracle and Google ; eBihar is thus an extra international master2 track on BIG DATA and AI for the local master students

2) 2) MID-term (with required joint administrative country agreementt), joint hybrid degrees with 50% of local courses and 50% MOOCs

Formal CDC opening in Latin America (Univ. El QUINDIO, Armenia, **Colombia**) in Oct.2022 and **PANAMA** (UTP) in 2023 for central Latin-America countries (Costa Rica, Honduras, Mexico,..)

October 2022 : agreement signature in Armenia with Governor, rector and scientific counsellor of the French Embassy

Micro-Credentials :

Dual Certificates leading to JOBS

BIHAR GRADEO to meet SKILL demand in Big Data, AI and Application development

Double certification included :
3 or 6 ECTS (CONCEPTS- what?) and
PROFESSIONAL Certification (TOOLS- HOW?)

DUAL CERTIFICATION LEADING TO JOBS

GRADEO : continuous professional development for UP-SKILLING and RE-SKILLING

◎ A growing demand from employees for short programs that provide new skills and focus on the labour market needs.

◎ The European MOOC consortium has defined a common **microcredential** framework to tackle these issues : "GRADEOS"

GRADEO

|	
100-150 hrs workload 4-6 ECTS	**Assessment combined with a reliable method of ID verification**
Level : Bachelor or master	**Transcript with specification of learning outcomes, hours, level and credits earned**

ESTIA
INSTITUTE OF TECHNOLOGY

DATUM ACADEMY

Conclusion : AI eLearning international dynamics around BIHAR master degree

1) BOTTOM UP APPROACH to build an **International BIHAR AI Institute** with hybrid learning (50%) leveraging on existing Connected Digital campuses and their DATA LABS
1) Master 2 BIHAR (existing since 2020)
1) Bachelor and Master1 BIHAR in 2024 (Campus France? BPI? CHINA? Madagascar? Oman? Panama?)

2) Free **popularization MOOCS** and Free AI webinars on FUN platform & DATUM ACADEMY
1) - AI BY EXAMPLE (« *AI360 » Mooc*) in Sept 2023 around POCS of the Bihar DATA LAB
2) -**CHATGPT** (« *PROMPT-U » Mooc*) in Sept 2024 (with 10 multidisciplinary university professors)

3) **BY-EXAMPLE Series** of **functional gradeos** (with ORACLE) both for managers and Computer scientists around POCs of the DATA LAB

4) **Virtual** customized **tutoring platform** and learning-by-doing services (*IAGORA*) based upon CHATGPT and BART and *HOOK project* (DATUM PHD with FUN Mooc platform)

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CONCLUSION : See you "bihar" *
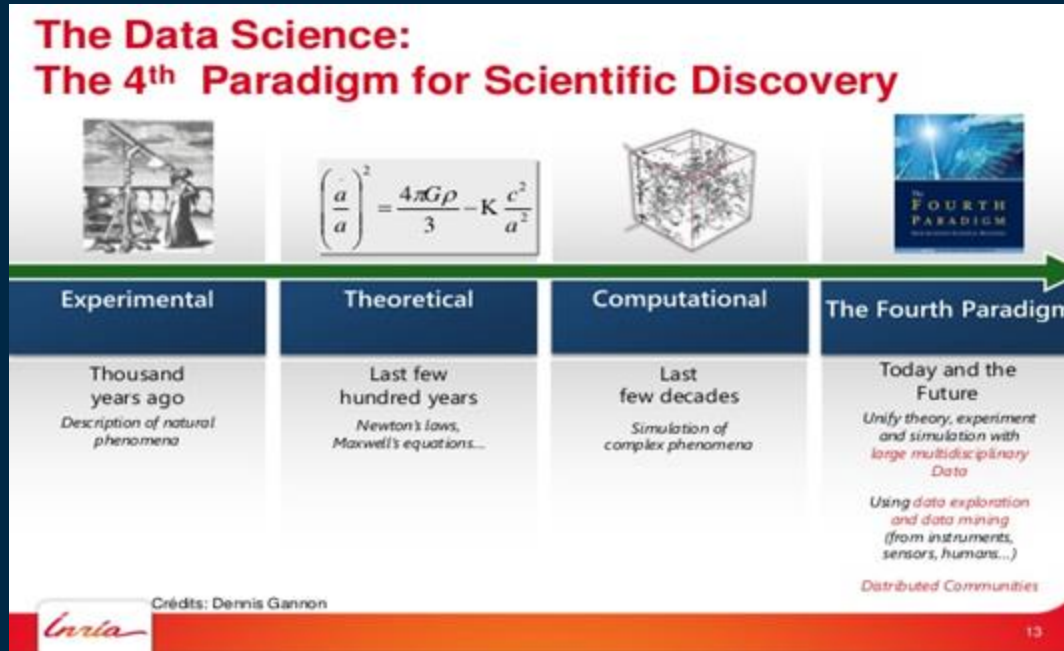to create AI MULTIVERSITIES with
their DATA LABS !
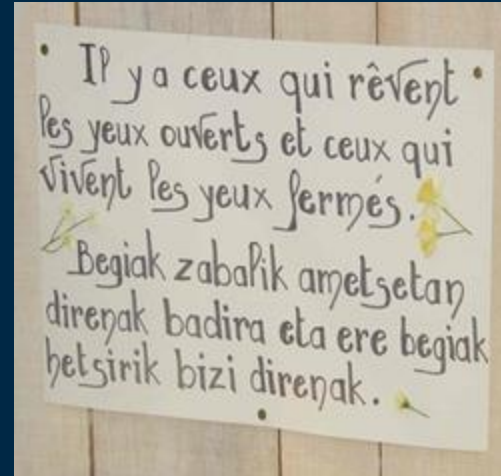
* "BIHAR" means "TOMORROW" in Basque language

EXTRA SLIDES

Major IT disruption in the DATA ECONOMY
« the 4th (DATA-centrics) paradigm of science : the SCIENCE of DATA »
(Jim Gray)

Jim GRAY, IBM, .. Microsoft
(TURING AWARD/*Nobel Prize in Computing* 1998)

DATUM ACADEMY with ESTIA

- eBIHAR Master (M1 & M2) < M2 available in FR and GB>

-

« International Bihar institute » :
On AI Engineering/3 years
With a BACHELOR on Applied AI

The DATA LAB at Estia and in a connected digital campus for POCs (support for functional gradeos)

BIHAR

www.jecandidate.estia.fr/

Applications are OPEN for on-line eBIHAR MSc and its GRADEOS

eBIHAR

Both English & French on
www.datumacademy.com

GRADEO

ORACLE University

Google Cloud

ESTIA
INSTITUTE OF TECHNOLOGY

DATUM ACADEMY

DATA refinery

- STRUCTURED data
- Semi-structured data
- Unstructured DATA

Extended DATA TYPES :
Matrices : XML, JSON, Objects,
Graphs, (KEY,VALUE), RDF,
pixel array, tensors,
OLAP

DATA lake

Multi-model DBMS

DATA Warehouse

Information/ Insight/ decision

Example : Multi-model
POSTGRES : SQL+ +NOSQL (Key,
VALUE) + JSON + XML in 2019

- Data Mining

- Machine learning, Deep learning

AI Teaching in France — FRANCE 2030 report (➡ building BIHAR curriculum)

Dec 2021 French national Report : FRANCE 2030
3 basic jobs in AI

1) (Big) **DATA SCIENTIST**

2) (Big) **DATA ENGINEER**

3) (Big) **DATA**-centric **APPLICATION DEVELOPER** (web & mobile)

BOTTOM UP approach to build BIHAR Msc curriculum

4.1 Aligner l'offre de formation avec les besoins des entreprises

Data Scientistes
- Fondamentaux mathématiques de la data science, des algorithmes de ML/DL et de la robotique
- Préparation et nettoyage des données / Techniques de réduction de la dimension
- Conduite de projets de data science - IA de bout en bout jusqu'à l'optimisation des modèles
- Maîtrise d'une ou plusieurs sous-disciplines : traitement du signal, vision par ordinateur, traitement du langage naturel, IA embarquée, robotique autonome, etc.

Ingénieurs de la donnée
- Techniques de stockage des données volumineuses (bases SQL, objets, colonnes distribuées, clés/valeur en mémoire, new SQL, etc.)
- Techniques de calcul parallèle et construction des processus Extract Transform Load : en entrepôts de données ou en architecture virtuelle
- Techniques de traitement des flots de données en temps réel (Data Streaming)

Ingénieurs logiciels ML/IA
- Méthodes de programmation industrielle adaptées à la data science et à l'IA
- Automatisation du déploiement des modèles par utilisation de pipelines, orchestrateurs et conteneurs
- Gestion structurée du cycle de vie des modèles via le monitoret et la maintenance versionnée
- Développement des techniques de robustesse, d'intelligibilité et de conformité des modèles en production

AI EDUCATION in EUROPE (Sept 2022 & January 2023 calls) : « the move to a more digital world, the digital transition » : 580 Millions Euros over 7 years

https://digital-skills-jobs.europa.eu/en/latest/news/eu-boosting-its-digital-talent-new-digital-call-education-programmes-key-digital

All Member States are currently facing a shortage of ICT specialists, *as pointed out also by the jobs mixing sectoral competences with a proficient understanding of key digital technologies are in high-demand everywhere. Young people are looking for programmes and courses to* **prepare them for jobs in the green and digital economy***. The new Call under the DIGITAL Europe Programme,* **'Specialised education programmes or modules in key capacity areas'***, will support the development of Bachelor's and Master's courses, jointly designed by universities, research centres and businesses active in the digital domain.*

Digital Skills &
Jobs Platform

AI learning targets

COMPUTER SCIENTISTS
- data scientists and big data architects
- general-purpose CS and dual skilling
- technicians

MANAGERS
- deciders
- Middle management
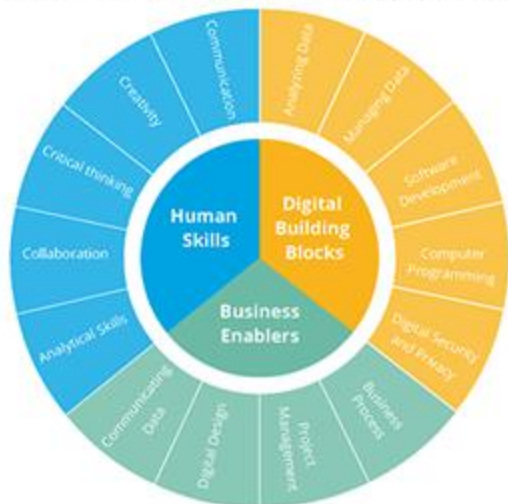- active employees and citizens
  (cf AI360 MOOC)

Graduate foundation skills in the data economy

The New Foundational Skills of the Digital Economy

These 14 skills, already in wide demand by employers, command salary premiums and are crucial for workers who want to keep pace with a changing job market.

© Burning Glass Technologies

Blocs de compétences visés par MSc BIHAR

Compétences numériques (ABCDE)
◎ Gestion de données
◎ Analyse des données
◎ Développement d'applications
◎ Cybersécurité et Cloud

Compétences business
◎ Gestion de projet
◎ Communication de données
Compétences humaines / soft skills
(à travers des projets et des cas d'usage industriels)
◎ Créativité
◎ Collaboration
◎ Compétences analytiques
◎ Esprit critique
◎ Communication

ARTIFICIAL INTELLIGENCE AND BIG DATA ARCHITECT IN THE CLOUD

ESTIA — Google Cloud — DATUM ACADEMY

GRADEO : certificates leading to jobs

Google Cloud Courses (Google Cloud Career Readiness Program)

INTERMEDIATE SPECIALIZATION COURSE		BEGINNER COURSE
Data Analyst specialization 16 weeks	**Associate Cloud Engineer Specialization 16 weeks (certificate included)**	**Cloud Digital Leader (certificate included)**
Mining and preparing your data with BigQuery	Google Cloud Platform Basics: Basic Infrastructure	Introduction to digital transformation with Google Cloud
Creating new BigQuery datasets and viewing insights	Google Cloud Infrastructure Essentials: Foundation	Innovating with data and Google Cloud
Get advanced insights with BigQuery	Google Cloud Core Infrastructure: Core Services	Modernising infrastructure and applications with Google Cloud
Apply machine learning to your data with GCP	Google Cloud Elastic Infrastructure: Scaling and automation	Understanding Google Cloud security and operations
	Google Cloud Reliable Infrastructure: Design and process	COURSE OFFERED TO THOSE WHO DO NOT HAVE THE BASICS IN CLOUD

ESTIA — INSTITUTE OF TECHNOLOGY

Pr. Marco GORI & Stefano MELLACI
University of Siena (UNISI)
Teachers of Artificial Intelligence

Pr. Serge MIRANDA
University Côte d'Azur (UCA) & ESTIA
Big Data Teacher

Information & Enrolment for GRADEO and Master eBIHAR on www.datumacademy.com

ARTIFICIAL INTELLIGENCE AND BIG DATA ARCHITECT IN THE CLOUD
in partnership with Google Cloud

DURATION: 6 MONTHS
PRICE: 999 €
ENROLMENT : ALL YEAR ROUND
DELIVERING: 6 ECTS & 2 GOOGLE CERTIFICATES*
LEARNING MODE: 100% ONLINE

The AI and Big Data architect must master 3 environments at the heart of this GRADEO :

1. The management of DATA, both structured with pre-definition of a fixed schema (SQL3, OQL), semi-structured with meta data (SparQL) and unstructured (NOSQL, New SQL) as well as the concepts of DATA WAREHOUSE and DATA LAKE.
2. The analysis of DATA with computer methods (Data Mining and OLAP), statistics (Machine learning in supervised or unsupervised mode) or based on AI with the fundamental approach of Deep Learning (multi-layer neural networks)
3. The Cloud which is the future of DATA management and analysis

Academic courses from ESTIA's Master BIHAR/eBIHAR

BD2: from databases to Big Data 6 weeks	**Artificial Intelligence : Machine Learning & Deep Learning 6 weeks**
BIG DATA paradigms and Codd relational data model for structured data	Mathematical tools for AI
Introduction to SQL2, relational SQL	The basics of Machine Learning
ChrisDate's third manifesto for hybrid object-relational data models	The basics of Deep Learning
Introduction to ODMG	Learning with Deep Learning
Introduction to SQL3, object-relational SQL	Computer vision, natural language
NOSQL and NEW SQL for unstructured data	Software for Machine Learning

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3 GRADEOS with Oracle

ADVANCED SQL PROGRAMMING

✓ OBJECT-RELATIONAL DATABASES AND SQL STANDARD

✓ SQL ON ORACLE CLOUD

BIG DATA & ARTIFICIAL INTELLIGENCE

✓ ARTIFICIAL INTELLIGENCE MLDL

✓ DISTRIBUTED BIG DATA MANAGEMENT

✓ MACHINE LEARNING ON ORACLE CLOUD

FULL-STACK MOBILE WEB DEVELOPMENT

✓ FULL-STACK MOBILE WEB DEVELOPMENT

✓ JAVASCRIPT & HTML5: DEVELOP WEB APPLICATIONS ON ORACLE CLOUD

BIHAR master : from CDC (Connected digital Campus)
And its « DATA LAB » (Bihar POCs) towards
"International ESTIA Bihar institutes'" (on AI Engineering)

*Planned network of 20 CDCs in the 5 continents before 2030 ***

With **4 International "AI INTERNATIONAL INSTITUTES" (***MULTIVERSITIES; ESTIA BIHAR*)** in the next t

years : **AFRICA (Madagascar) , MENA, LATIN AMERICA, CHINA, ASEAN (Vietnam)**

2 CDC opened in 2022 in Africa representing **44 eBihar/Bihar master** students in 2022 and 80 in 2023: :

ESATIC (Ivory Coast) & © ITU (Madagascar)

Other signed/discussed CDCs for opening with **GRADEO immediate Distribution** :

© AFRICA : **AFRIA /Benin, TOGO (IAEC) , SENEGAL (DIT, UVS)**,   **Cameroon** ,

Gabon, Burkina, Nigeria , Mauritius

© ASIA : **CHINA (SRBS)** , INDIA (Amrita, Kerala), **Vietnam (DANANG)**, Korea, Russia

(Astrakhan)

© EUROPE and MENA : **Northern Cyprus (EMU), Italy (Siena), France (Univ Lyon), Spain**

(Uni Vigo), Univ SORBONNE (Paris) Bilbao/DEUSTO, Romania (CLUJ),   IRAK & Lebanon, OMAN,

BARHAIN, Qatar, Turkey, MOROCCO , Algeria, Tunisia

© SOUTH AMERICA : **Haiti, Dominican Republic, PANAMA, COLOMBIA** ,Brasil,

Mexico (Yucatan), Guatemala, Costa Rica

Partenariat du MBDS avec groupe MDI avec le président Cyril Nègre sur services mobiquitiaires et big data pour la voiture à air comprimé Juin 2019

DATA LAB: Smart Car, Smart city, Smart FARMING, DEEP HEALTH, Deep Marketing, Digital circular economy

4 SKILLS sets within BIHAR MSc *leading to JOBS*

DATA ENGINEER
✓ DATABASE ADMINISTRATOR (SQL & NoSQL)

✓ DATA WAREHOUSE & BIG DATA MANAGER

DATA LAKE architect

DATA SCIENTIST
✓ MACHINE LEARNING & DEEP LEARNING

✓ ARTIFICIAL INTELLIGENCE ENGINEER

ML/MLOPS PIPE LINE Architect

BIG DATA DEVELOPER
✓ WEB APPLICATION DEVELOPER

✓ NATIVE MOBILE DEVELOPER AROUND NEW TECHNOLOGIES (NFC, AR, BLOCKCHAIN)

FULL-STACK app dev/architect

CLOUD DATA ARCHITECT (with Google and Oracle)

ESTI INSTITUTE OF TECHNOLOGY

DATUM ACADEMY

M1 BIHAR (ESTIA)

SEMESTRE M1A

Ce semestre fait partie du parcours sur 24 mois avec Bac+3 (180 crédits ECTS)
comme niveau requis pour l'admission. Il correspond à une mise à niveau permettant
de valider les pré-requis du semestre M2A.
Planning : de mi-octobre l'année N à fin janvier l'année N+1.

Bloc compétences	Code module	Module	Heures CM	Heures TD/TP	Total heures
DATA ENGINEERING	S11	Bases de données objets (SQL3, OQL)	25h	45h	70h
DATA ENGINEERING	S12	Administration des bases de données avancées	15h	20h	35h
DATA ANALYSIS	S13	Fondamentaux mathématiques de l'Intelligence Artificielle	30h	40h	70h
DATA ANALYSIS	S14	Languages de programmation de Data science (PYTHON Niveau1)	10h	25h	35h
SOFTWARE DEVELOPMENT	S15	Fondamentaux du développement Web	25h	45h	70h
SOFTWARE DEVELOPMENT	S16	Conception du projet	15h	20h	35h
SOFTWARE DEVELOPMENT	S17	Interaction Homme-Machine	15h	20h	35h
Total			135h	215h	350h

M2 BIHAR (ESTIA)

Bloc de compétences	Code module	Module	Heures CM	Heures TD/TP	Total heures
DATA ENGINEERING	S21	Bases de données objets (SQL3 et OQL) avec Oracle Clouud	10h	25h	35h
DATA ENGINEERING	S22	Bases de données du Big Data et DATA LAKE avec Oracle21C	30h	40h	70h
DATA ANALYSIS	S23	Machine Learning I	30h	40h	70h
DATA ANALYSIS	S24	Deep Learning I	15h	20h	35h
SOFTWARE DEVELOPMENT	S25	Développement full stack web et mobile	25h	45h	70h
SOFTWARE DEVELOPMENT	S26	Méthode agile	15h	20h	35h
SOFTWARE DEVELOPMENT	S27	Intégration continue et développement continu	15h	20h	35h
			140h	210h	350h