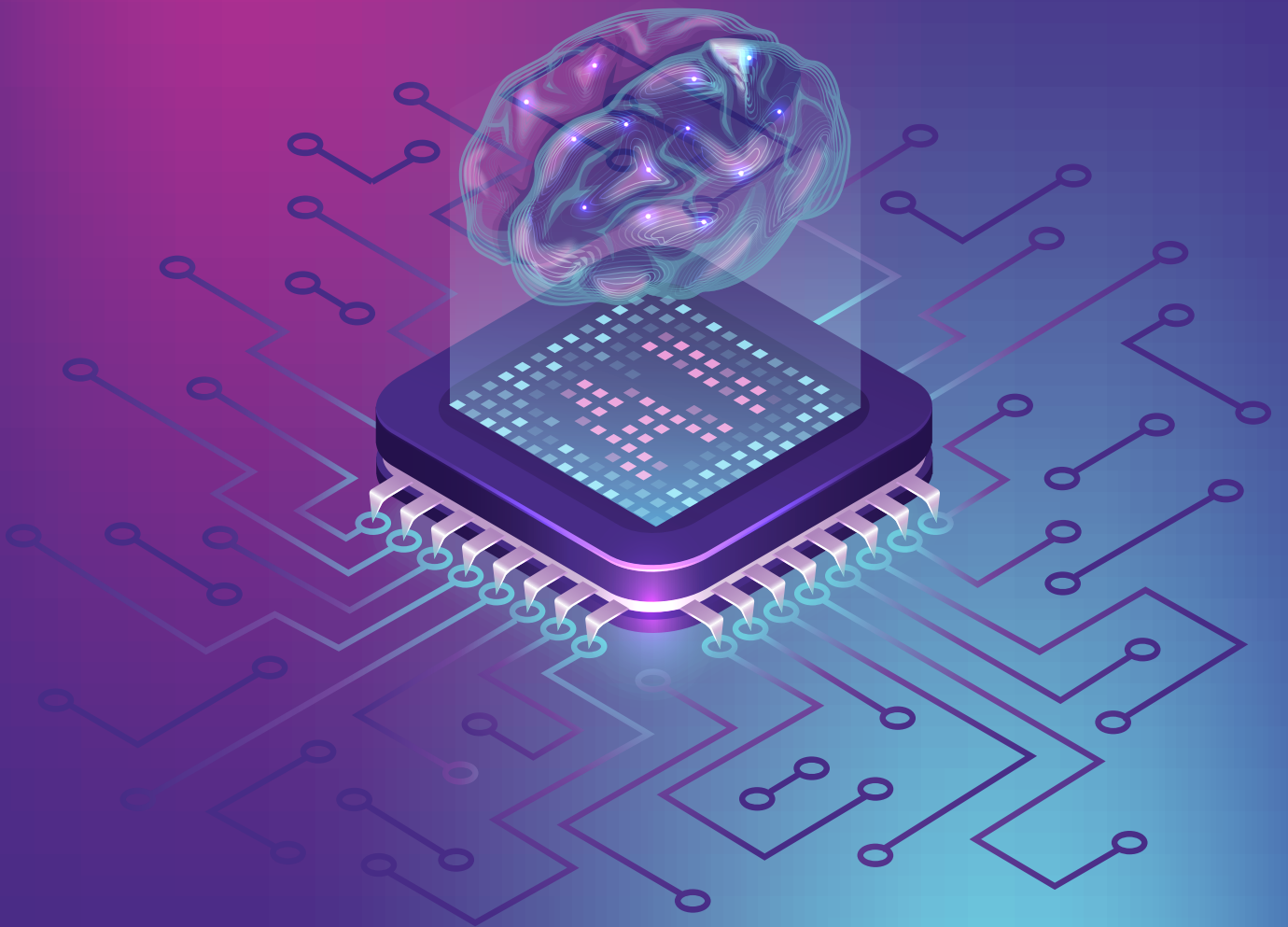# ARTIFICIAL INTELLIGENCE, MACHINE LEARNING AND DATA SCIENCE

THE FUTURE OF HUMAN-AI-ML COLLABORATION

Artificial Intelligence (AI) and Machine Learning (ML) have transformed the way many businesses and industries work, including healthcare, education, cyber security and marketing. AI is a field of computer science that includes machine learning, natural language/speech processing, expert systems, robotics, and machine vision. It enables computers to perform tasks traditionally completed manually by automating decision making, learning and recognition. In some instances, human subject matter experts provide feedback on results as part of training or testing process and in turn ML dynamically updates programming code to improve the algorithms. The methodology used by AI can be represented by various graph and network structures. For example, an artificial neural network or neural net is a system designed to process information by simulating the framework of biological brains to automate tasks.[i]

AI has the potential to imitate the human brain, which makes it unique among technologies in that it can learn and solve problems that would normally require human intelligence. In general, AI includes natural language and processing, visual perception and pattern recognition, and decision making. These processes in combination give AI enormous potential in multiple disciplines and across many economic sectors.

ML is a branch of AI which is a method of data analysis that automates analytical model building. Machine Learning breaks down an algorithm into three main parts, a decision process, an error function and a model optimization process. The ability of machines to learn from previously available data, but evolved into newer models, is the process of Machine Learning. Instead of consistently teaching machines, allowing them to adapt to and learn from previous computational methods to produce reliable, consistent and valid results.[ii,iii] To further understand the difference between AI and ML, you can read more at SAS Institute.[iv]

DATA SCIENCE AND ITS IMPORTANCE

For those who have been researching on what the best job in the 21st century is, they will surely land on the title "Data Scientists". Explaining Data Science is not that simple, the reason being that this one term consists of Mathematics, Statistics, Data Engineering, Scientific Methods, Advanced Computing, Visualization, Domain Expertise and a Hacker Mindset.[v,vi] According to IBM, Data Science also includes elements of storytelling. To say that Data Science is a multidisciplinary field would be the correct way to define it. Similar to ML, Data Science is also a subset of AI.[vii] Data Science uses scientific methods, processes, algorithms, and systems to extract knowledge and insights from structured and unstructured data and applies the knowledge and actionable insights gained from data across a broad range of application domains. In today's world, we are constantly creating data through websites, apps, communication and social media. To manage such a huge amount of data, we need Data Science.

The Data Science platform market size is expected to grow from USD 37.9 billion in 2019 to USD 140.9 billion by 2024, at a Compound Annual Growth Rate (CAGR) of 30% during the forecast period. Other data from Statista shows that in 2021, the global big data market is predicted to be worth USD 64 billion.[viii]

AI, ML AND DATA SCIENCE IN PAKISTAN

AI, ML and Data Science in Pakistan is adopting rapidly and poised to grow significantly over the coming decade. Pakistan is rapidly growing and adopting new and improved technologies in healthcare, education, civic services, marketing and finance. The advancements in data collection, processing, increased computing power and low costs of storage have resulted in numerous startups focusing on AI, ML and Data Science. These startups are offering insights into the control of new diseases, identifying patterns of human interactions, setting up smart electrical systems and intelligent irrigation systems, offering data mining and security solutions, powering smart cities, analyzing shopping data, identifying tax evaders and policing.[ix,x] Additionally, companies working in this field are also offering training and capacity building in AI, ML and data science. Many international organizations such as S&P Global, Mentor Graphics and Teradata are also working successfully in Pakistan.

Industries	Companies
HEALTHCARE	Xylexa, Xpertflow
PUBLIC SERVICES	E-vaccs, Tax Dosti
GAMING AND ANIMATION	Saremco Tech, Cubix, Caramel Tech Studios
FINTECH	ABC Data, Unikrew
RETAIL AND E-COMMERCE	DAO Proptech, Hanker Technologies, Deal Smash, Lasting Sales, Peekaboo Guru, Fetch Sky
EDTECH	Dot & Line, Sabaq, Knowledge Platform, Edkasa, Jazz Smart Schools Project, Orenda
DIGITAL MARKETING	Logo Design.Net, Mountainise, Botsify, Saremco Tech, Codistan, Penumbra, Revolution Flame
NEWS AND CREDIT RATINGS	baseH Technologies, S&P Global
RESEARCH AND TRAININGS	Karachi dot AI, KICS UET Lahore (AILR), Research Center for Artificial Intelligence
MULTIPLE INDUSTRIES	Liquid Technologies, Revolve AI, Teradata, Afiniti, Byte Legions, Mercurial Mind (Pvt.) Ltd., Love for Data

PAKISTANI COMPANIES PROVIDING AI AND ML SERVICES IN PAKISTAN

baseH Technologies

Founded in 2017, baseH Technologies has been providing custom-made solutions with AI and ML. The organization developed the first AI news writer in Pakistan named Dante. This AI content generator creates content that is exactly like human writing using Natural Learning Processing (NLP). The company made it so that it can generate news using metrics from various reports. BaseH Technologies received $4 million initial funding, which the highest funding received by any AI and ML startups in Pakistan.[xi]

Due to Dante, baseH is progressing and soon become the future unicorn in Pakistan.

> *Automation today is not about machines doing what humans can do but it is about humans not having to do what machines can do for them.*

Minahil Khan
Lawyer - Research Society of International Law

Company of Intelligence Systems & Networks Research (CISNR)

CISNR is using AI, ML, Smart Grids and other technology to save energy and to maintain economic growth. They have developed many successful projects including ICT-AI KPK Valley, Safe Roads, SCADA, ElectroCure, Intelligence Transportation System ITS, Smart Disaster Management, and Smart Environment. Among all these projects, ElectroCure is highly funded by Ignite with about PKR 39.9 million. ElectroCure is a device that is an electrical metering system. They are also employed by Jazz Telecommunication Service to avoid energy losses and to increase energy access through mobiles in Pakistan.[xii]

Afiniti

Afiniti is a US-based Pakistani data and software unicorn that uses AI and ML to increase the profitability of an enterprise. One of the products by Afiniti is the AiRo™, which is a behavioral pairing technology for small and medium enterprises. Another product named "Afiniti" is a behavioral pairing technology which is also being used by AT&T. Today, Afiniti is serving various sectors with 700 million customers and has 1.3 million interactions each day.[xiii]

ADDO AI

ADDO Ai provides intelligent data platforms, AI and data strategy and use cases. Forbes In 2017 considered ADDO Ai as the fourth leading AI Company in Asia. This company has been able to serve the healthcare, ecommerce, telecommunications, fintech and logistics sector by analyzing data architecture, data leaks, data engineering, and processing. Currently, the organization is focusing on developing smart cities with an OS based on AI and ML. Since 2017, ADDO Ai crossed the borders of 5 countries including Singapore, Germany, UAE, Philippines, and Pakistan, expanding their services for the largest airline service. Notable clients that ADDO Ai has served include Singtel, Telenor, Ooredoo, Habib Bank, UOB, Bank of Central Asia, Duty Free Shopping and more.

> *When it comes to choosing a tool, know what you want. ADDO AI's team digs deeper to assist your core business needs.*

Aamir Shah

Research Center for Artificial Intelligence (RCAI)

RCAI is one of the well-known research institutions in Pakistan that are involved in the research and development of innovation of AI and to produce cost-effective products, funded by Silicon Valley. They are running various AI projects including an Intelligence Irrigation System. Though the project is under construction, test showed that using this technology resulted in about 40% of water being conserved.[xiv]

FiveRivers Technologies

With 17+ years of experience, FiveRivers Technologies is playing a key role in system management technology, mobile applications, AI, VR, and IoT based on AI. Under its Data Science and AI service, FiveRivers uses AI, ML and Data Analytics to provide meaningful insights and reports to its clients. This company developed 150 applications with 20 million downloads up till now. Notable clients that FiveRivers has served include OCHA, Samsung, Ufone, Clearcube and more.[xv]

VisionX

Islamabad-based VisionX provides innovative products and services to startups, enterprises and furtune 500's. The organization helps clients with products that can intelligently recognize text, create new data insights, real-time alerts and Augmented Reality (AR) powered experiences. Products that VisionX provides include Mailroom, which automates manual tasks, Parcel, which helps track deliveries, Sight, which uses AI and ML to make cameras intelligent and Spatial Studios that helps small businesses and enterprises leverage the technology of 3D content.[xvi]

NexDegree

NexDegree helps businesses drive with impact through their services in data analytics. It has developed many projects using AI and ML technology with major transport, healthcare, urban development, telecom, natural disaster prediction, and energy conservation organizations, local and international. Its product for computer system analysis, Fovea.io helps in optimizing energy-related algorithms to reduce carbon footprint and the cost of energy sources.[xvii]

> *The deep technical expertise and experience that the NexDegree team extends to any project is absolutely amazing.*
>
> *CTO, Social Media Aggregator*

Mountainise

Mountainise helps businesses thrive by providing them solutions in digital media management. One of its products, Mountainise Innovative Artificiance (MIA) is an AI-based performance optimization solution. MIA increases business performance by fourfold without any additional inputs into the business. The organization uses ML to analyze information and drive strategies for helping sales and marketing using AI tech. Mountainise had the benefit of working with Fortune 500 companies, such as Google Partner, Facebook, IBM and Adobe Marketing Cloud.[xviii]

> *We love their in-depth understanding and enthusiastic approach to problem-solving*

Garfield Connolly, Chief Technology Officer, Medxnote

Analytics Pvt Ltd (APL)

Analytics Private Limited (APL) provides a range of tech-enabled solutions including Data Consultancy, Software Development, Data Warehousing, AI, Advisory Services, Cyber Security and more. APL is using the state-of-the-art technology based on AI and has worked with Microsoft, Allied Bank, Adamjee, Emirates, Byte and many more. A unique service that it provides is to combine automatic shot tracking, golf performance monitoring, and advanced analytics to help golfers to make better decisions.[xix]

> *Analytics has been instrumental in helping us devise our Data Strategy & Roadmap. Their consultants have shown remarkable capability in aligning our upcoming data ecosystem investments with our business priorities and goals. Undoubtedly, this engagement required a rare blend of business acumen and technical thought-leadership, which I must say, Analytics thoroughly exhibited.*

President and CEO, Khushhali Microfinance Bank

10Pearls

Pakistan's 10 Pearls designs, develops and maintains different software, web, and mobile applications. It facilitates AI design and strategy, augmenting data science resources as well as providing digital advancement in business innovation and evolution. Since 2004, the global reach of this company has been increasing at a fast pace. It also provides diverse services including DevOps, SecOps, web and mobile app development, customer experience, new product development enterprise software development, cybersecurity, and AI to business models of today.[xx]

> *They can make short term sacrifices to produce results quickly and do it without causing problems down the road.*

Director of Engineering, Jeenie

Cubix

Headquartered in Karachi, Cubix is a mobile app that provides AI, Blockchain, Gaming, Mobile and Web App Development and On-Demand Delivery Solutions. The services that Cubix provides in AI and ML include facial recognition, location tracking, motion sensing and web conferencing. It provides several products under Marketing and HR as well, known as the Cubix Happyface and Cubix Shop, with a purpose of automating these departments for its clients.

> *I loved working with Cubix. I was surprised to see how genuinely the team was interested in making my app a success in the industry, instead of how most companies just want to get done with the work. They kept suggesting how to improve the app's designs and also accommodated my recommendations. I hope to work with them in the future as well.*

Denise Marcus, Director of Operations, DataStream[xxi]

Programmers Force

Programmers Force is an AI-based firm with regional offices in Pakistan and its head office in the UK. The organization provides AI-based products and services mainly for the Fintech sector. However, its products and services also include Application Programming Interface (API) development and integration, fintech solutions, enterprise applications, mobile app development and big data processing to facilitate corporate clients.[xxii]

> *Professional and trusted service providers in today's emerging tech industry!*

Sarim Sheikh

Code Junkie

Code Junkie works for the development of various software using AI and ML including customer care, marketing, sales, management and security. Through its expertise in AI and ML, it provides predictive analytics, natural language processing and recommendation engines. Code Junkie has worked with several local and international clients to make various software that perform distinct functions. Some of these products include Smart-Face, Giga Mall App, Firefighter Simulation using NLP, BuzzMusik, and Aletheia.

> *I was impressed that the company considered all of my ideas and budget limitations and let me complete my project.*

Owner, Buzz Musik

NorthBay

NorthBay provides tech-enabled solutions in Pakistan and globally. Through its services in AI and ML, many companies have been able to transform and scale their businesses along with speed in decision making. Apart from AI and ML, its services include application development, database, application migration, data warehouse. Its key clients include BestBuy, Best Doctors, Delloitte, Eliza, EMC, Kitara Media, Random House, and Mozilla.[xxiii]

Imroz

Lahore-based Imroz provides product-oriented services to early-stage startups. Imroz helps people to build smart, cloud-native software and applications which deliver experiences that help the customers in developing different businesses using AI and ML technology. It provides many services including Product and Digital Strategy, Cloud-Native App Development and Analytics, all powered by AI and ML. Its key clients are Erie Genetics and Jazz.[xxiv]

D2Vision

D2Vision is an expert in mobile development, computer vision, multimedia, surveillance, video streaming, machine learning, virtual reality, and augmented reality and automation technologies for mobile platforms using AI technology. Its key clients include E-Facto France, Smart Touch Systems Pakistan, andEverCam Ireland.

Xpertflow

Xpertflow is a technology solutions provider which is focusing on automating the Healthcare industry with its Deep Tech products. Its product Nostro is a device that can be moved around, along with its dashboard for collecting accurate insights and analytics. Another one of Its products is Nwear, which is a wearable technology powered with AI, providing accurate health information, such as heartrate. Finally, its product Nview is a management software for patient information, appointments and other deliverables.[xxv]

Zettabyte Systems

Quetta-based Zettabyte Systems provides data backup and recovery and data center services. One of the products that it provides is Kaspersky which provides data security for different applications and servers. Another one is Bitdefender with plans for different levels of businesses including Bitdefender GravityZone Business Security, GravityZone Ultra Plus, Bitdefender Total Security and more. The solutions offered by Zettabyte Systems can be installed and deployed immediately. [xxvi]
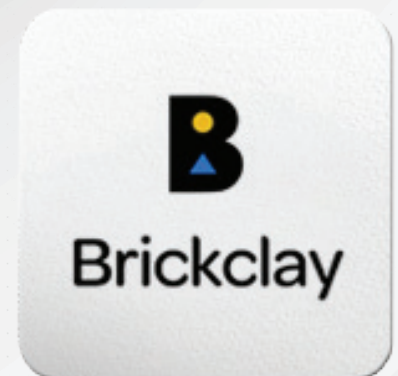
Datum Brain

Datum Brain is working on researching and developing top-notch distributed systems that involve big data, graph databases, high-performance computing, reactive web applications and data science pipelines. Datum Brain has worked with 17+ businesses in helping them understand their data and data usage. The organization also has a tech-stack with different data science solutions to choose from.[xxvii]

> *The team at Datum Brain was excellent to work with. They communicated clearly, understood my requirements, stayed within the budget for our project, and were extremely professional. I'd highly recommend them to anyone needing custom development work done.*

Skyler Reeves - Ardent Growth

Brickclay

Brickclay, based in Karachi, provides data insights and data analytics by adopting ERP systems, big data systems, cloud systems, social media and IoT devices and also by tools and techniques related to data science and data mining. Through its expertise in Data Science, Brickclay is able to transform complex data into comprehendible data for data integration, performance management, evidence-based business decisions and predictive analysis. Brickclay also offers its own platform called Quick Analytix, through which analytics and insights can be shared amongst business peers to make informed decisions.[xxviii]

Data BI

Islamabad-based Data BI develops business intelligence tools, dashboards, reports, data visualizations for multiple organizations, startups and institutes. The tools offered by Data Bi are essentially data-driven Decision Support Systems (DSS). Categorically, the services provided by Data BI include data visualization, dashboard development, interactive business intelligence tools, predictive analysis, data warehousing, business intelligence training and consulting. One of Data BI's projects include building a Safety Measures Audit Dashboard for Brock.[xxix]

Virtuosoft

Virtuosoft provides IT as well as big data services. At Virtuosoft, historical data of a business is used to make effective analytics and trends.

The services include data warehousing, trends creating and predictive analysis. Additional services that Virtuosoft provides include data science, data performance and sensor analytics services. The organization has worked with many international clients and one of these include offering data analytics services to Uber and Pakistan International Airlines.[xxx]

ABC Data Private Limited

Working towards maximizing its clients ROI, ABC Data Pvt Limited provides comprehensive data-focused tech solutions. Its tailor-made solutions include enterprise data warehousing implementations, big data implementations, business intelligence and reporting, cloud implementations, advanced analytics, data migration and performance reporting. The platform has also launched "Sarmaaya", which is a Pakistan Stock Exchange (PSX) authorized data redistributor. Sarmaaya allows users to track their portfolio and performance. Another one of its products is the Dataspeck, which is a security information and event management. ABC Data also provides trainings in Hadoop, Spark and solving business challenges.[xxxi]

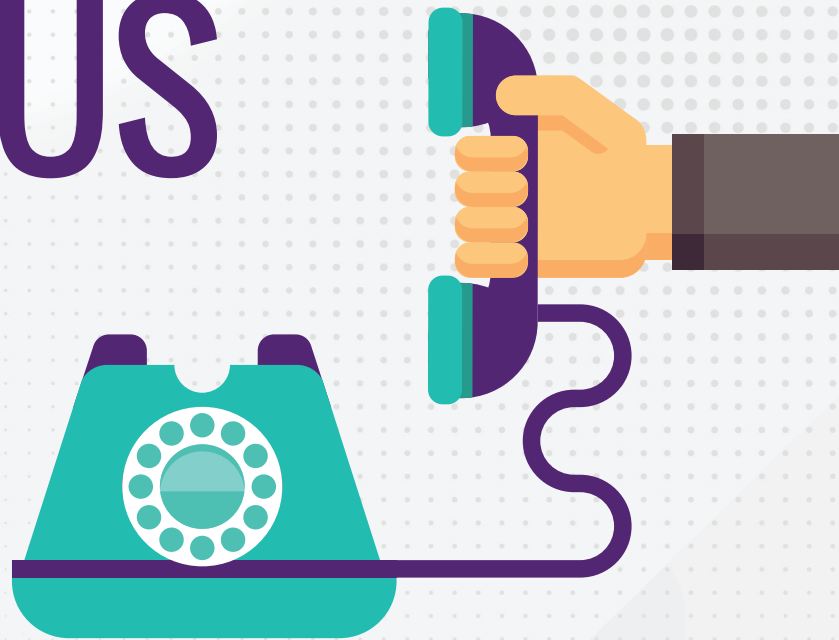# THE WORLD OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING IS EXPANDING

Now that countries are moving towards vaccinations and a "New Normal", technological advancements will continue to increase. AI and ML have already transformed the way processes, programs and interactions work. Experts have predicted that investment into AI and ML will continue to increase, thereby expanding the range of products and services that these technologies can automate.[xxxii] The E-commerce, Healthcare, NLG and EdTech industries widely using AI and ML, and the technology is swiftly expanding into households as well. In Pakistan, companies are using AI and ML technology to revolutionize the healthcare, educational, software, fintech and marketing industries. These companies are providing services to local and international clients and are generating large revenues. The quality of these services is recognized internationally and soon, Pakistan is likely to become the hub for AI and ML.

REFERENCES

i. Department of Computer Science and Engineering, 2021. Robotics and Artificial Intelligence (Online). University of Minnesota. Available at: https://cse.umn.edu/cs/robotics-AI?field_category_target_id=7046

ii. SAS Institute, 2021. Machine Learning. SAS Institute. Available at: https://www.sas.com/en_us/insights/analytics/machine-learning.html#:~:text=Machine%20learning%20is%20a%20method,decisions%20with%20minimal%20human%20intervention.

iii. IBM, 2021. Machine Learning. IBM. Available at: https://www.ibm.com/cloud/learn/machine-learning

iv. SAS Institute, 2021. Machine Learning. SAS Institute. Available at: https://www.sas.com/en_us/insights/analytics/machine-learning.html#:~:text=Machine%20learning%20is%20a%20method,decisions%20with%20minimal%20human%20intervention.

v. Towards Data Science, 2021. What Is Data Science, and What Does a Data Scientist Do? TDS. Available at: https://towardsdatascience.com/data-science-articles-that-provided-value-in-2020-70ba3799ed1f

vi. Oracle, 2021. What is Data Science. Oracle. Available at: https://www.oracle.com/pk/data-science/what-is-data-science/

vii. Oracle, 2021. What is Data Science. Oracle. Available at: https://www.oracle.com/pk/data-science/what-is-data-science/

viii Statista, 2021. Big Data Market Forecast. Statista. Available at: https://www.statista.com/statistics/254266/global-big-data-market-forecast/

ix. Tribune, 2019. Capital's cops to get facial recognition devices soon. Tribune. Available at: https://tribune.com.pk/story/1937963/8-capitals-cops-to-get-facial-recognition-devices-soon

x. Tribune, 2019. Govt to use NADRA's database to detect tax evaders. Tribune. Available at: https://tribune.com.pk/story/1928627/2-govt-use-nadras-database-detect-tax-evaders

xi. TechJuice, 2021. Artificial intelligence startup baseH Technologies raises undisclosed seed level investment at $4 million valuation. TechJuice. Available at: https://www.techjuice.pk/artificial-intelligence-startup-baseh-technologies-raises-seed-level-investment-at-4-million-valuation/

xii. CISNR, 2021. Services. CISNR. Available at: https://cisnr.com/services.php

xiii. Afiniti, 2021. Products. Afiniti. Available at: https://products.afiniti.com/

xiv. Facebook: Research Center for Artificial Intelligence

xv. FiveRiver Technologies, 2021. Services. FiveRiver Technologies. Available at: https://www.fiveriverstech.com/

xvi. Vision X, 2021. Products. Vision X. Available at: https://visionx.io/

xvii. NexDegree, 2021. Services. NexDegree. Available at: https://nexdegree.com/

xviii. Facebook: Mountainise

xix. Analyics, 2021. Solutions. Analytics. Available at: https://analytics.com.pk/

xx. 10Pearls, 2021. Services. 10Pearls. Available at: https://10pearls.com/services/

xxi. Cubix, 2021. Services. Cubix. Available at: https://www.cubix.co/services

xxii. Facebook: Programmers Force

xxiii. LinkedIn: NorthBay

xxiv. Imroz, 2021. Framework. Imroz. Available at: https://imroz.io/framework/

xxv. Xpertflow, 2021. Products. Xpertflow. Available at: http://xpertflow.com/index

xxvi. Zettabyte Systems, 2021. Services. Zettabytes Systems. Available at: https://zettabytesys.com/

xxvii.. Datum Brain, 2021. About. Datum Brain. Available at: www.datumbrain.com

xxviii. Brickclay, 2021. Services. Brickclay. Available at: https://www.pasha.org.pk/d/l/brickclay/

xxix. Data BI, 2021. Services. Data BI. Available at: https://databi.me/services/

xxx. Virtuosoft, 2021. Services. Virtuosoft. Available at: https://virtuosoft.pk/big-data-services/

xxxi. ABC Data, 2021. Products. ABC Data. Available at: https://www.abcdata.org/products

xxxii. Patnaik, P., et al., 2021. Future of Artificial Intelligence: Will People be at More of an Advantage Than They Are Today? Scrivener Publishing LLC. Available at: https://doi.org/10.1002/9781119711148.ch5

TALK TO US

DO YOU RUN A BUSINESS IN THE ARTIFICIAL INTELLIGENCE, MACHINE LEARNING AND DATA SCIENCE INDUSTRY?

GET IN TOUCH WITH YOUR DETAILS NOW AT
MEDIA@TECHDESTINATION.COM
AND WE'LL TAKE IT FROM THERE.

ALSO EMAIL US FOR ANY COMMENTS, SUGGESTIONS
OR ERRORS IN THIS WHITEPAPER.

FOR MORE INFORMATION ON
REGISTERED COMPANIES, PLEASE VISIT
HTTPS://TECHDESTINATION.COM

ABOUT THIS INDUSTRY ROUNDUP

Pakistan Software Export Board developed this paper by hiring services of an independent consulting firm to prepare this roundup on Pakistan's Artificial Intelligence, Machine Learning and Data Science sector. The paper focuses on Pakistan-based companies in this vertical and apprises the reader of the expertise available in Pakistan in the Artificial Intelligence, Machine Learning and Data Science domain.

DISCLAIMER

A product of TECH destiNATION Media

Commissioned by:

Ministry of Information Technology & Telecommunication
DIGITAL PAKISTAN

PAKISTAN
PSEB
SOFTWARE EXPORT BOARD

TECH destiNATION PAKISTAN

Developed by:

epiphany   cybervision INTERNATIONAL

Publishing year: 2021