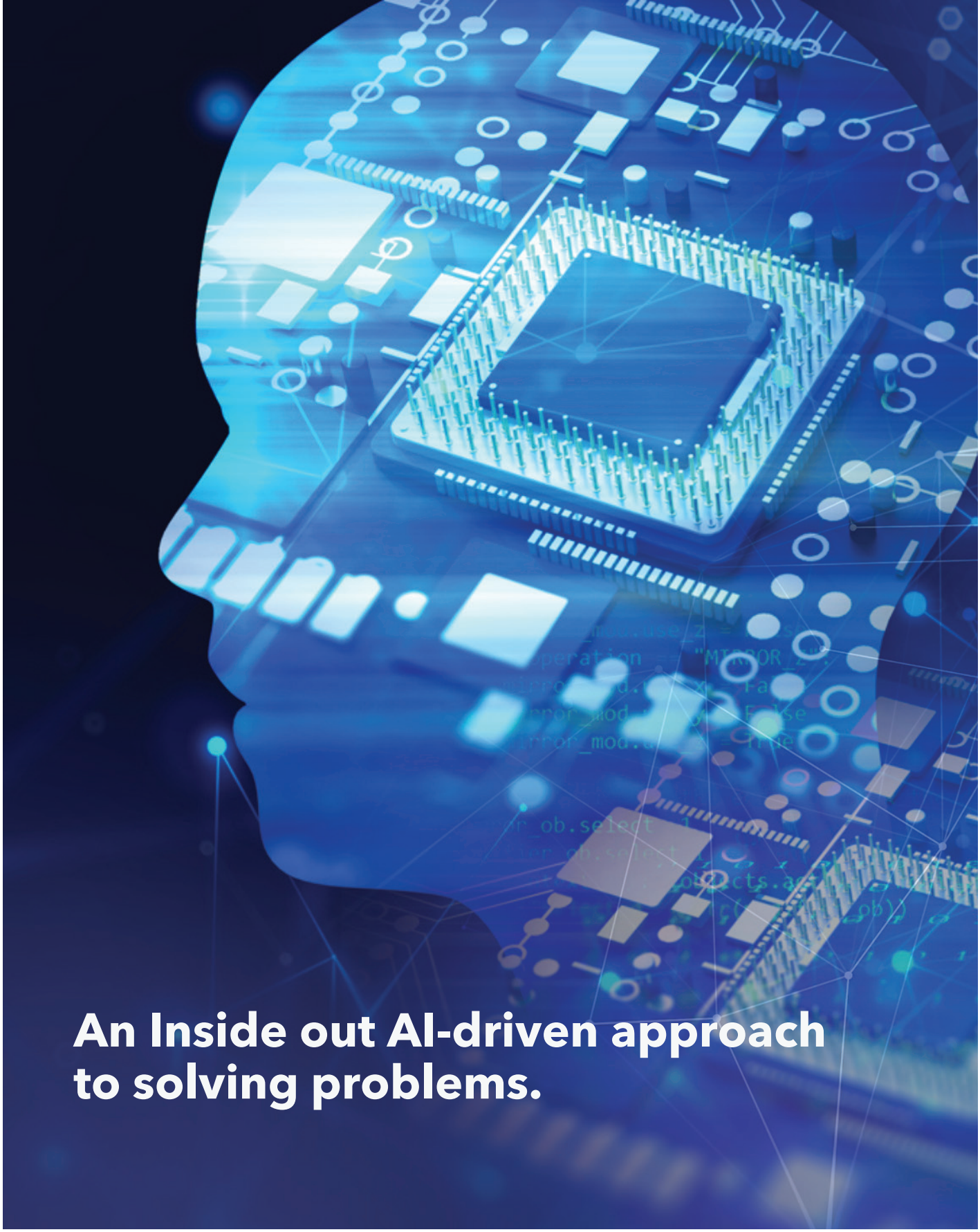

An Inside out AI-driven approach to solving problems.

CSS CORP

www.csscorp.com

Take a moment to look around.

Cars are driving themselves. Automation is everywhere. Even drones—once a symbol of cutting-edge technology—have become a household toy.

These are clear signs that artificial intelligence and machine learning have become democratized.

But as powerful as they are, using AI and ML to solve business problems is not a simple process. There are plenty of pitfalls to be avoided, and many project teams don't fully understand how to work with AI and ML technologies.

Algorithm Libraries: The Smart Choice for a Fast-Paced Ecosystem

There are more than 50 common machine learning algorithms, all with different applications. There is no single algorithm that solves all problems, and it can be tempting for AI/ML adopters to develop their own in-house solution.

However, building new ML algorithms can be a huge challenge. A significant investment is required to get these projects off the ground, and it's difficult for most AI/ML adopters to compete with established players like Amazon (AWS), Microsoft (Azure), and Google. Often a better alternative is to hire researchers and engineers who can work with and apply the existing ML libraries built into major cloud platforms.

Off-the-shelf ML algorithms are best suited for evolving markets that need rapid access to working solutions. Use cases are often complex, and solutions typically require extensive testing and performance manipulation before they are fit for purpose. Working with pre-existing, bug-free algorithms is an important advantage here, because it speeds up the development and deployment process.

Of course, not all business problems can be solved using algorithm libraries. More complex problems will usually need to be built from scratch by experienced R&D experts. This type of work requires a lot of creativity, and—for the time being at least—can't be completed without human ingenuity.

Solving Problems with AI & ML

Developing business solutions with AI and ML isn't easy. Projects are often hindered by a lack of understanding of the underlying dynamics, dependencies, and data required to solve the problem.

Following are the five steps engineers must take to successfully build AI and ML solutions. When one or more of these steps are missed—as often happens—serious issues often arise.

Step #1: Understand the problem

It might seem obvious, but before any development can occur, engineers must have a thorough understanding of the problem to be solved. At a minimum, the team must identify the dynamics associated with the problem, a list of internal and external dependencies, and data attributes.

Methods that can be used to ensure this include:

5 Whys

Mind Mapping

Online analysis

Domain SME discussion

Step #2: Understand data points and create a list of direct and indirect factors

Having a thorough understanding of existing data is essential, particularly because engineers must be able to identify any features that could influence the AI/ML model.

Common tools and methods to help with this stage include:

Data analysis

Statistical methods

Data interpolation and extrapolation

Feature extraction methods

Research

Step #3: Determine whether AI/ML is appropriate

This is perhaps the most important step in any development project: Determining which technologies should be used to solve the problem. Because of their popularity, many development teams opt to use AI and ML even when they aren't the ideal choice.

Good questions to ask are:

- Can the problem be solved with rule-based-analysis?
- Is the output strongly influenced by less than 1 to 4 metrics?
- Are there any existing functions that can facilitate the desired output?
- Is the problem computationally very difficult, but with a fixed outcome?
- Is it simple to group the data or series of inputs?

If the answer to any of the questions above is a "strong yes", the project may not be a good fit for AI and ML.

Step #4: Spend time on feature engineering

The core of solving any ML problem is data input, and one of the most challenging tasks is establishing effective features that are dependable for ML classification. Based on the nature of a problem, features must be extracted from transformation. This requires significant expertise in (and application of) data engineering concepts.

Many teams fail to complete this stage thoroughly, resulting in the project being derailed or facing roadblocks.

Step #5: Apply ML algorithms contextually

Selecting the correct ML algorithm for a problem requires the use of KPIs such as accuracy, precision, recall, MCC, and F2 measures. These metrics must be analyzed extensively before a decision can be made.

There is no "minimum data" formula, as it is highly driven by the complexity of the problem.

Selecting the Right ML Algorithm

The steps described above are essential to the success of any AI/ML development project. However, it's equally important to ensure the correct ML algorithm is selected. Getting this decision wrong can (and often does) undermine the success of the entire project.

Once the problem, data attributes, and project objectives are thoroughly understood, an informed decision can be made on which algorithm to use. Broadly, algorithms fall into four categories:

- Supervised learning
- Semi-supervised learning
- Unsupervised learning
- Reinforcement learning

Typically, when datasets are clear and consistent, supervised learning algorithms are a good choice. On the other hand, when data is complex or unclear, unsupervised learning algorithms are more appropriate.

Beyond this, there are several things to keep in mind when selecting an algorithm. Perhaps most important, there is no single algorithm that can solve all problems. Contextual application of ML algorithms is essential to project success, and algorithms are highly likely to fail if applied in the wrong context.

Your choice of algorithm must be made objectively and based purely on which is best suited to the problem at hand. Just because you happen to have resources who specialize in the use of a particular algorithm doesn't mean it's the best choice.

Watch out for 'biases' in AI based solutions

As is often the case with emerging technologies, businesses are scrambling to build and adopt AI/ML solutions, and thereby one must expect projects to fail for

1. Many businesses want to adopt AI/ML simply because they are new and exciting, rather than because they are the ideal solution to an existing challenge.
2. Many businesses do not have the in-house talent to enable successful development projects. Often, they may have engineers with limited AI/ML skillsets, forcing them to develop solutions using non-ideal ML algorithms
3. There other major issues observed in AI based projects are the inherent bias introduced unknowingly into the data and/or the algorithm, and as a result works fine for ideal-scenarios
4. The metrics used by engineers for the measuring the AI has to be neutral and holistic. There are chances of metrics mis presentation due to biases in the data

So, what can we learn from this? Quite simply, have a structured testing process to evaluate the entire process of solution development and with the right expertise to measure true outcomes

Kiran Marri, Ph.D.

VP Solutions - Engineering & Testing Services

Dr. Kiran Marri is testing leader, industry consultant, educator and an avid researcher with over 18 years of software and systems experience. He is currently Vice President, CSS Corp Limited, Bangalore. His role is to develop innovative solutions, create sustainable business models forgrowth, and launch new services in the Digital, Engineering and Testing practices. He received his B.E degree from University of Madras, M.S by research and Ph.D. from IIT Madras. His current research interest is to apply machine learning techniques and optimization algorithms to solve complex engineering & software problems, build solutions for early validation strategies, develop user experience tools for global clients.

He has published over 70 papers at various international and national conferences in Biomedical engineering, Software testing, Signal Processing and Machine learning areas. He has won 4 Best paper awards in 2004, 2011, 2014 and 2015 at International conferences. Dr. Marri can be reached at Kiran.Marri@csscorp.com

For more information, **contact info@csscorp.com**

Copyright © 2019 CSS Corp. All Rights Reserved.