Delivering on AI Challenges—Is this Easy or What? Points and Pitfalls

Artificial Intelligence (AI) used for maintenance diagnostics, target/person recognition, business decision support and mission effectiveness.

AI seems to be infused everywhere.

AI systems are being applied in traffic pattern analysis be it for cyber threat detection or to ensure that automotive traffic moves efficiently. We now have AI "neurons" at the socket level of an application defending against know attacks/mistakes as well as non-regular activities. We use AI for maintenance diagnostics, target/person recognition, business decision support and mission effectiveness.

Everyone wants it and development capabilities are being fielded to allow workers the opportunity to solve their specific problems using AI. Providing an AI engine is a start but there are significant challenges to developing and using an AI-based system.

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Expert Systems were one of the first AI engines (circa 1965) where a user would establish a decision tree, output response given known inputs. Analogical Expert Systems used the same decision tree but the user evaluated the result so the system could learn.

Neural Networks are more sophisticated (circa 1959). Now with sufficient computer processing capability, they form the base for machine and deep learning capabilities. Further developments in Neuromorphic computers and the use of support tools such as graph clustering will increase the effectiveness and the learning intelligence of AI systems.

Analysis Not Magic

But let's remember that these AI engines are just a collection of code that has been programmed by a team of people. It's not magic. Decisions may seem mystical especially when we see deep learning AI systems presenting seemingly unique results. These results are derived from the analyses (segmented and recursive) of large sets of training data; sometimes augmented with human assessment.

Thus, the authoritativeness and completeness of the training data with relevant mission/business data elements is essential. Fusion of multiple data sets linked by key data elements may be required. In many enterprises, the same data element is in multiple systems/databases, so ensure that only authoritative data elements are used.

Time sensitivity of data needs to be considered to ensure data currency as well as fusion in the same time frame. Lastly, training data/interaction must represent the complete range of use cases or inaccurate results may result, e.g., if most maintenance data is only for trucks, applying the results to tanks may be questionable.

Accuracy Essential

After training, the AI system's output results need to be evaluated. An accuracy goal must be established. Accuracy is usually based on human assessment of the results which can be a very arduous process using SMEs and others. The assessment needs to be for complete problem scope which may not be feasible. Various heuristic and estimation procedures can assist but the accuracy should be adjusted accordingly.

If the result is not sufficiently accurate, several remedial actions should be considered. For example, using more related data/datasets for training, combining/weighting of key characteristics, or constraining results to a specific input scope. For some AI systems, accuracy can be the effectiveness in meeting a goal (e.g., driving to a destination) by optimizing factors like time and resource cost.

Since AI system is code, there can be an unknown bias injected by the development team or by the AI engine itself.

Since data can evolve over time due to other external factors (environment, economy, disasters, etc.), the AI system (and the development team) must learn that change is inevitable and adjust to maintain accuracy. Unanticipated data values need to be assessed for additional system training or a potential input error that needs to be corrected.

Since AI system is code, there can be an unknown bias injected by the development team or by the AI engine itself. This can be difficult to assess since many AI engines cannot explain the logic leading to the result. AI ethics are emerging concerning inherent biases in results including second/third order effects with concerns for privacy, fairness, justice, and trust.

For autonomous vehicles, ethics are a major concern since the AI system may make independent decisions based on optimizing the objective success criteria. This may lead to unpredicted behavior since multiple resulting actions can be used to meet the success criteria. When an autonomous vehicle meets an obstacle, actions available include emergency stop, crash, veer off. Any of these can have adverse primary/secondary effects on passengers, bystanders, infrastructure, etc. while meeting the success criteria.

As we start fielding AI systems, we need to be cognizant of these ethical/data bias concerns. The need exists for a comprehensive assessment regime (automated) where "all" results/actions with secondary/tertiary effects are assessed before production. With AI harnessed correctly, we have a partner to support the innovations needed to significantly improve our overall health and welfare. ■

About The Author

Mr. Konieczny is CEO of FK Innovation Consulting, LLC, which currently provides independent technical consulting/solutioning and technical advisory board services to organizations in both the commercial and government sector. He served as the AF CTO (2010-2021) focused on bringing technology innovation into the Air Force. Prior, Mr. Konieczny he has held several C-level positions in commercial industry managing multiple government and commercial projects. He has received multiple award (e.g. FedScoop, Fed 100, internal company) for technology accomplishments.

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