Axiom
Human Resource Solutions

WHITE PAPER

# Human Capital Management in the Age of AI

Our HCM Solution suite is leading the way in artificial intelligence (AI) for human capital management (HCM) by applying it practically in the flow of work to facilitate action and boost strategic impact across the employee lifecycle. This white paper lays out AI best practices and differentiators with case studies around flight risk, employee experience, and compliance.

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## The Analytics Lite advantage

Analytic Lite's advanced algorithms analyze massive amounts of data to provide in-the-moment insights for HR professionals, managers, and employees:

- Predict key trends like flight risk, succession likelihood, potential, and fatigue to boost retention and build a strong employee experience
- Serve up proactive, personalized resources and process recommendations in anticipation of HR needs to boost efficiency
- Accurately forecast business volume and critical staffing needs
- Automatically surface anomalies in predictive alerts to help managers and practitioners reduce suspicious behavior

## EXECUTIVE SUMMARY

AI[1] and machine learning[2] (ML) techniques are disrupting industries as well as products from thermostats to automobiles. According to Constellation Research, elastic cloud infrastructures are allowing more advanced decision support and prescriptive analytics capabilities, and there is a renewed and deepened focus on maximizing the employee experience[3]. These are both areas where AI can help, but how can HR teams best understand and apply these techniques at their organizations? This paper discusses the experience with AI for human capital management (HCM), particularly in the product. First, it describes the AI best practices to use, covering the lifecycle from matching a business problem with an AI technology through testing and delivery. Next, it covers specific AI advantages, including:

- Leveraging Artificial Intelligence for Managers and Employees (Analytics Lite), an advanced AI engine that works behind the scenes to analyze data in real time and provide advice to guide critical decisions
- Utilizing employee life cycle data within the HCM platform architecture to find patterns hidden across an organization
- Applying knowledge of features and metrics that drive workforce trends, fuel a strong employee experience, and enable proactive decisions/actions
- Testing and refining with real data based on customer partnerships and research

Detailed benefits of using AI in specific HCM case studies are covered at the end of the paper. Examples of how AI can make HCM easier include the following:

- Employee flight risk detection can be automated into predictive alerts, leading to greater employee retention and reduced hiring costs
- **Employee experience optimization and personalization** based on patterns of behavior among employees, managers, and HR professionals can allow ongoing proactive decision making based on flexible scoring structures and faster task completion through anticipating activity cycles in the HCM platform
- **Anomalous behavior detection** can actively deliver alerts on indicators of suspicious activity in an organization, such as retroactive schedule changes or excessive time card edits, potentially reducing fraud and non-compliance risks

## INTRODUCTION: AI, ML, AND HCM

AI is profoundly changing the nature of modern work, including the field of HCM. Our HCM Solution is at the forefront of this revolution. This section provides background on AI and some specific HCM examples. AI best practices, advantages, and specific solutions are covered later.

1 S.J. Russell and P. Norvig, *Artificial Intelligence: A Modern Approach,* 3rd ed., Upper Saddle River, NJ: Prentice Hall (2010).
2 Christopher M. Bishop, *Pattern Recognition and Machine Learning* New York: Springer (2006).
3 Holger Mueller, *Kronos Is in the HCM Market for Good*, Constellation Research, October 22, 2019, found at https://www.kronos.com/resources/kronos-hcm-market-good-research-report

## What is AI?

AI is not a single monolithic algorithm or even a particularly unified field. It is a collection of different approaches that attempt to solve problems traditionally associated with human intelligence. These approaches include computer vision, natural language processing, automated planning and optimization, and ML. In addition, each of the subfields that fall under AI have classes of algorithms matching particular kinds of problems. For instance, consider ML, which generally covers approaches that extract patterns or models from data. Within ML, there are many classes of algorithms, including:

Unsupervised ML, where data is analyzed to extract features or patterns that best generalize or describe the data. Examples include clustering algorithms and component analysis algorithms.

Supervised ML, where each row of data has an associated label (in a classification task) or number (in a regression task) that the model is meant to predict. For instance, a predictor of employee flight risk would access historical rates of employees leaving a company to help calibrate, or "train," it. Tools and techniques for solving these types of problems include deep neural networks, decision tree ensembles, support vector machines, and Gaussian processes.

Other techniques or variants of the above include *semisupervised learning* (where only some of the data have labels), *preference learning* (where the predicted labels are hidden and must be inferred from choices or direct queries), and *reinforcement learning* (where an AI agent makes sequential decisions with the intention of minimizing costs).

This rich landscape of solutions is both a wealth of untapped potential and a possible headache for HR practitioners if their business problem is ill-defined. To build AI in HR or any other domain, it is crucial to have a well-defined business problem and then match it to the right subfield(s), class, and algorithm.

## AI and HCM business problems

HCM covers a wide array of activities across the employee life cycle: recruiting, onboarding, benefits administration, payroll, workforce management (timekeeping, accruals, scheduling, etc.), compliance, people analytics, and all other aspects of an organization's people processes. While classical AI approaches have been used for a long time in some parts of this domain (for instance, stochastic search techniques used to generate schedules), more modern AI and ML techniques are now coming into play.

### ML vs. deterministic rules

In some cases, using deterministic or rules-based AI is the right approach. This is especially true in relation to compliance and an organization's best practices. We understand that there are times when either a rules-based or an ML approach is the best fit, and there are times when a combination of the two is better. Reminding employees to enroll in benefits or take vacations, alerting HR about employees close to qualifying for ACA or approaching FMLA leave status, and diagnosing scheduling, attendance, or payroll issues often require applying algorithms with set rules that don't require learning and inferring from historical data. The results of deterministic rules are always 100 percent accurate. On the other hand, predicting performance, absenteeism, or flight risk based on historical data or patterns with an acceptable degree of statistical certainty – almost never 100 percent – requires ML techniques.

To ground this discussion and show the quantifiable benefits of these techniques, this paper focuses on case studies in three areas where AI can improve HCM:

Employee flight risk detection – Attrition and turnover can take a major toll on organizations, especially in the current candidate's market where filling a gap with a replacement employee is taking longer than ever. Supervised ML approaches like random forests can help address this issue, generating flight risk predictions based on the most relevant contributing factors for different employees.

Employee experience optimization & personalization – The common thread connecting both employee experience and HR efficiency is anticipating needs. With optimization and preference learning AI techniques, it becomes possible to both build predictive scores monitoring key employee behaviors and proactively deliver resources to support the cycles of HR activities occurring at an organization.

Anomalous behavior detection – Compliance violations and fraudulent actions represent major sources of cost and risk for organizations. Unsupervised ML techniques such as clustering can isolate problematic patterns in HCM data and surface them before outlier behaviors like retroactive schedule edits, deleted punches, break time adjustments, and others lead to negative impacts.

These areas are not only core aspects of HCM but also high-value use cases. Finding flight risk issues early enough to retain employees could save employers on hiring and training costs, as well as productivity and morale costs from distributing the workload of an employee who leaves until a replacement is found. Personalization based on optimization and preference learning techniques creates efficiencies in the flow of work by anticipating user needs, which boosts productivity and frees up time for strategy. And anomalous behavior detection surfaces suspicious activities enough ahead of time for costly compliance penalties and fraud investigations to potentially be avoided.

## AI BEST PRACTICES AND DIFFERENTIATORS

### Best practices

Delivering a truly reliable business solution takes more than fancy AI algorithms. To ensure that AI and ML techniques drive HCM results, we use several AI best practices that apply across its solutions:

Match specific AI solutions to business problems with real-world value. There is no single monolithic “AI algorithm,” and we have been successful at pairing AI and business problems such as flight risk detection (supervised ML), employee experience optimization and personalization (preference learning and optimization), and anomalous behavior detection (unsupervised ML).

Innovate by combining AI with our HCM Solution’s unified, single-database approach to HCM data. Utilizing contributing factors across the full scope of the employee lifecycle rapidly to deliver real-time automation, prediction, and recommendation results without having to clean and reconcile data from disparate systems is a major differentiator for an AI solution.

Test models on real data through customer partnerships. These tests ensure both accuracy and alignment with customer needs.

Deliver understandable and actionable results to users. Delivery includes not only a usable front end but also a scalable back-end architecture.

### Differentiators

The best practices listed above are good academic guidance, but making them work in the real world requires significant infrastructure and processes. offers real-world differentiators in the AI space, including:

Leveraging Analytics Lite – Powering our HCM Solution suite, this advanced AI engine is built specifically for managers and employees to simplify daily tasks and provide predictive insights that guide better decisions. Analytics Lite does this by analyzing data across the employee life cycle and applying advanced algorithms.

Utilizing employee life cycle data within our HCM platform – Because its cloud-based infrastructure is built on a single database, our HCM Solution can collect and deliver the diversity of data points needed for modern AI approaches to establish a holistic view of HCM activities rapidly and in real time. No data reconciliation is required, which vastly reduces time to insight.

Applying knowledge – Arguably, the most important part of any AI solution is choosing the features and metrics to input, including how they are represented. This takes knowledge of not just what the AI algorithms do but also the business problems being addressed. What contributing factors matter most for predicting employee flight risk in the next three months? What metrics have the most weight when measuring fatigue, reliability, engagement, and other categories related to the employee experience? We use its deep experience unifying and consolidating these and many other HCM data points to surface factors that may not be traditionally considered or even accessible in other systems and arrive at the strongest answers possible.

Testing and refining with real data – As mentioned in the best practices above, this provides both a critical evaluation of the solution design and quantifiable confidence in its results. For instance, the flight risk detection solution described in the next section was tested on our customer base and was found to provide flight risk predictions with over 80 percent accuracy in their organizations.

## HCM CASE STUDIES FOR AI

To demonstrate the power and value of AI solutions for HCM problems, three case studies are described in this section. They cover flight risk detection, employee experience and personalization optimization, and anomalous behavior detection. Each case pairs the business problem with specific AI solutions and then describes engineered innovations and advantages as well as testing and delivery methods.

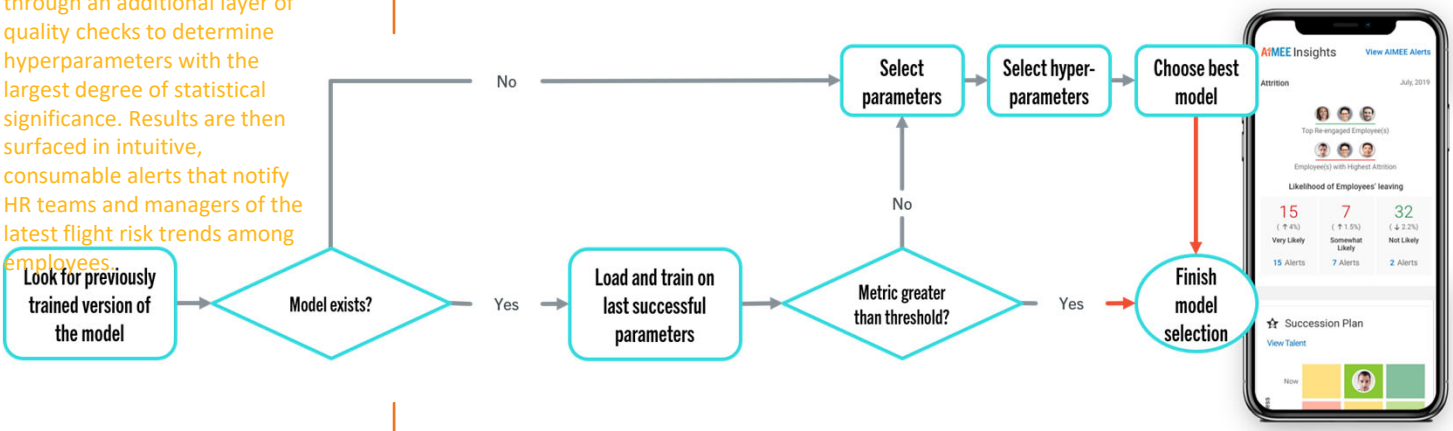
### Mitigating bias

We believe that mitigating the risk of bias in HCM decision making (such as around employee retention, which might be based on flight risk, growth potential, reliability, performance, etc.) starts with transparency. Our approach to leveraging AI to aid in this decision making is to be very straightforward and direct with our customers, and to align with proper standards to ensure the quality of our results. We accomplish this in several ways. First, our AI and ML models go through an additional quality verification step after testing, training, and initial data selection, identifying hyperparameters that produce the best results. Our models also primarily focus on data points that represent behaviors, not just demographics – metrics such as pay raises, performance ratings, incidents, absences, overtime, and other similar factors – which prioritize what employees are doing within an organization rather than who they are to lower the risk of bias. Finally, all AI development adheres to Google's responsible AI practices to further ensure bias prevention and quality results.

## Flight risk detection

Employee retention is a key concern for the majority of organizations regardless of industry. Lower unemployment numbers mean that less candidates are available to consider for any given job and that those who are available have an unprecedented level of choice over where they want to work. In this environment, employee turnover and attrition are both major threats that – beyond just increasing hiring costs – deeply impact the experience of the employees who stay at an organization across a variety of factors including work-life balance, engagement, performance, and productivity. To prevent turnover and attrition from snowballing, organizations need to proactively assess their employees' flight risk and take action to retain more of those who may be planning to leave. This is something AI is well-positioned to help with.

High-level architecture of supervised ML used to predict flight risk. Metrics are carefully considered each time the model is run, split into testing and training datasets, then put through an additional layer of quality checks to determine hyperparameters with the largest degree of statistical significance. Results are then surfaced in intuitive, consumable alerts that notify HR teams and managers of the latest flight risk trends among employees.




Automating flight risk prediction using AI allows HR teams and managers to gain insights into when and why employees are likely to leave without adding to their workloads. Additionally, on top of the cost impacts already mentioned, this type of AI-powered alert infrastructure positively influences an organization's culture and business continuity as employees receive proactive recognition from HR and managers, become re-engaged, stay longer, and move to more senior roles.

### How we address flight risk

Figure 1 shows the high-level process our HCM's AI solution for flight risk prediction follows. Several key innovations are part of this process:

- Contributing factors – There are a wide variety of contributors to flight risk, some of which remain uncovered in analyses that only consider a particular kind of data such as HR records, pay information, or time tracking metrics. We start by considering approximately 1000 different data points across the whole employee life cycle to build an initial flight risk model – features as diverse as hours, exceptions, cost centers, pay changes, tenure, performance review results, and many more – and then narrows those down to the most potent contributing factors, leading to stronger overall predictions.

Model quality – In addition to the standard process of splitting the data being analyzed into testing and training data sets, the ML model uses to predict flight risk includes a further round of quality checks to ensure the strongest results. After the model identifies an initial set of features and parameters from the testing and training data sets that meet its threshold for significance, it then performs a separate selection process to identify *hyperparameters* that produce results of the best quality. This ensures the model surfaces the factors with the most powerful impact on flight risk for a particular organization.

Uniqueness of results – A simple fact of calculating flight risk is that the factors causing it differ from company to company. The breadth of data the flight risk model considers combined with its extensive testing of the parameters it uncovers allow the results it presents to tailor themselves uniquely to the landscape of specific organizations, unlike many of the more typical AI approaches in the HCM industry. The model also retrains itself regularly over time to detect shifts in the most important contributors to flight risk at a company and further adjust itself to align with the environment in which it has been deployed.

The application of these innovations within our HCM Solution's AI approach to flight risk leads to the following overall advantages:

Trust across the organization that the information the AI delivers has been vetted thoroughly and is as accurate and relevant as possible

Clear contributing factors that are easy to explore for further details and provide intuitive paths to proactive action

Automated data exploration, testing, evolution of results over time, and insight delivery enables HR and managers to focus on decision making around instead of investigation of flight risk-related issues, increasing the success of retention efforts

### Testing and delivery

The flight risk solution described above was tested in collaboration with an advisory board drawn from active customers. Insights revealed through the testing process and subsequently developed into the product include the following:

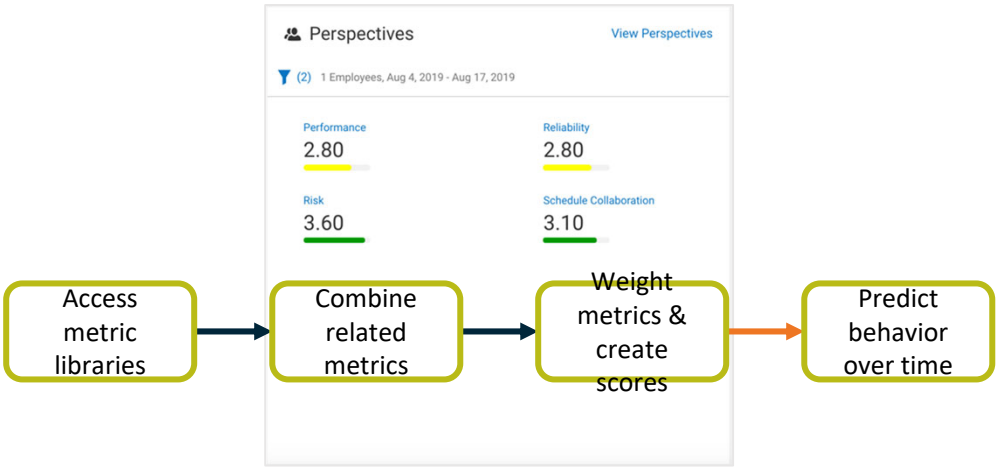
Visualization of top contributing factors to flight risk, both positive and negative, in model results

Easy access to data exploration directly from AI alerts to quickly corroborate findings

Insights into which employees have become re-engaged in addition to which employees pose a flight risk

## Employee experience optimization and personalization

As referenced in the previous use case, the current candidate's market is forcing organizations to evolve how they attract high-performing talent. A critical differentiator in these strategies is the employee experience a company creates. Complicating the path to success here is the fact that employees' expectations as consumers are influencing their expectations in the workplace, fueling a desire for consumer-grade experiences and technologies in a business context. Furthermore, much of the burden of crafting a strong employee experience falls on HR, a function already overburdened with administrative tasks to support employee needs. So how does a forward-thinking organization give HR back the time required to achieve a strategic focus, deploy the right technology, and build a unique employee experience?




Process flow for building predictive scores tracking workforce trends and employee behaviors . These scores are customizable using a variety of metrics from across the HCM platform, allowing relevant insights for different organizations to be built. These scores then become automated and deliver behavior predictions over time to enable proactive conversations that improve the employee experience.

AI has the capacity to become the connecting thread between employee experience and HR efficiency. Optimization and preference learning techniques are quick to put in place at an organization and can serve the dual function of tracking/predicting employee behavior *and* cycles of HR activity. In this way, a single AI framework can help anticipate both employee and HR needs and automate both the delivery of the insights needed to proactively influence the employee experience and the resources needed to effectively manage recurring HR tasks.

### How we optimize the employee experience and personalizes the HR experience

The process flow highlighted in Figure 2 represents the steps taken to generate employee and team scores in Our HCM Solution's Perspectives tool. This approach includes the following innovations around predicting employee behavior to improve their experiences at an organization:

Flexible metrics – Contributors to a positive employee experience and indicators of positive or negative employee behaviors vary greatly from company to company. For this reason, we do not define the data points considered when evaluating these areas ahead of time. Instead, a library of key metrics from across the employee lifecycle is available, which our HCM Solution's unified platform enables. Organizations then choose the metrics most relevant to them and build scores based on them.

Metric combinations and weighting – Simply choosing single metrics, such as pay, performance, open shifts claimed, or others is not a nuanced enough picture to capture what factors affect the employee experience. For this reason, we allow multiple metrics to be combined into intuitive scores – such as overtime hours, shift intensity, and incidents being used to indicate fatigue – and the metrics used can be weighted differently to reflect which factors have more or less influence on the score the organization chooses to monitor. This ensures that the scores generated are fine-tuned to match the unique culture, environment, and business priorities in place at specific companies.

Scoring automation and aggregation – In order to remain relevant over time and show upward or downward trends, scores need to automatically adjust in real time whenever they are accessed. The AI embedded in our HCM Solution automatically recalculates created scores in real time whenever they are accessed, can display all employee scores in a single team view for comparison, and can generate average team scores. In this way, organizations can predict behavioral trends both on an individual and group level and make proactive decisions that positively impact the employee experience.

Our approach to optimization and preference learning also apply at a deeper level within our HCM Solution platform, as they are also used to monitor HR team activity and anticipate their needs. For example, AI tracks HR events that occur on a cycle, such as benefits enrollment, ACA filing, etc. and proactively delivers resources to HR professionals ahead of when it predicts those events will next occur, boosting HR's efficiency with administrative efforts.


Process flow for AI identifying and delivering insights around cycles of HR activity personalized to specific users. These notifications, tips, and links automatically and proactively facilitate action around key events in the employee life cycle, increasing HR's efficiency with administration to allow more time for strategy.

Figure 3 shows some example notifications the AI generates around different key activities, tasks, and events. These alerts link directly to the area of the platform where the item referenced can be completed to facilitate action, or to learning options with tips on managing larger, more complex processes. Multiple innovations are included as part of this:

Pattern recognition – Simply reviewing system audit reports is not enough to understand which activities are important to HR, on top of it being a time-consuming process. Instead, AI leverages these reports to establish larger patterns of behavior over time, enabling it to determine which events are of high importance and match the right processes and resources to anticipate HR's needs around them.

Focus on development – Getting a quick path to completing an HR activity is only useful if the person carrying out that activity is confident in the steps needed to execute it. To ensure HR professionals have that confidence going into different tasks, the AI delivers tips and educational resources in addition to quick paths to the areas of our HCM Solution's platform where different tasks should be carried out. This ensures HR achieves maximum efficiency during the task itself by preparing team members ahead of time with the knowledge required to be effective.

Intuitive access – Personalization goes beyond technical process; it has design impacts as well. Any resources delivered in anticipation of upcoming events or tasks need to be displayed in a way that is simple to access and easy to find. For this reason, we have embedded the notifications, links, and tips the AI serves up within the home page area, which users access regularly. This creates a one-stop shop for personalized results and a central location from which to execute on the recommended activities.

The innovations cited in both the examples above lead to the following overall advantages:

Clear standards for evaluating employee and team behavior trends and proactively building an employee experience based on these standards

Anticipation of both employee and HR needs in the flow of work

Boosted HR efficiency in completing recurring tasks, regardless of complexity

### Testing and delivery

The employee experience optimization and HR personalization solutions described above have been tested with customers through a series of focus groups and workshops, as well as being based in analyses by subject matter experts of customer behavior patters within our HCM Solution. Specific insights gained from testing include:

Aggregation of employee insights into team views for quick information processing at the HR and manager levels

Customization of scores using a flexible metric library

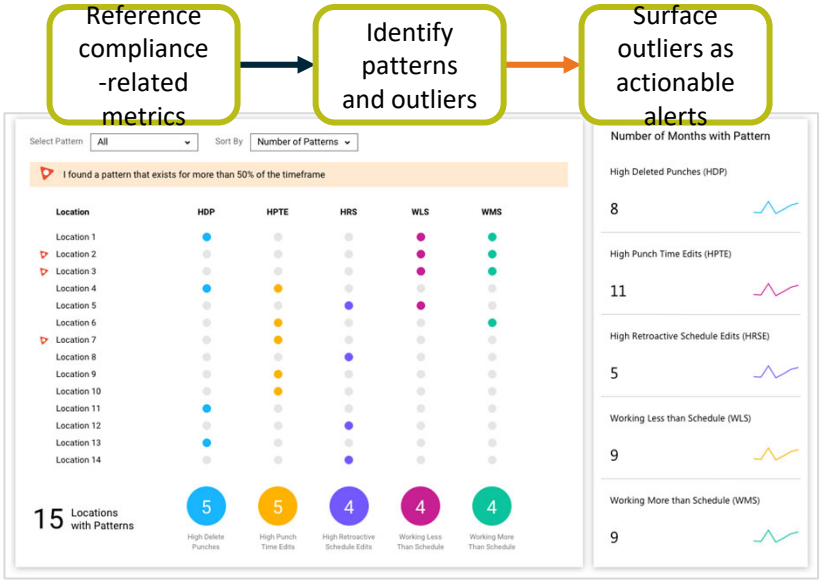
Direct linking to platform areas of importance for completing different tasks

User interface improvements to streamline the experience of accessing both personalized HR insights and Employee Perspectives scores

## Anomalous behavior detection

Compliance violations and fraudulent activity, aside from being high-risk and high-cost for any organization, consume a large amount of time and energy for HR departments when they are forced to react to problems that have already occurred. And with the constant stream of compliance changes taking place at the local, state, and federal levels, it can be difficult for HR just to maintain standards – let alone track and influence the behavior of others.

AI using unsupervised ML can help HR proactively reduce compliance and fraud risks by recognizing anomalies in manager and employee behavior and automatically surfacing those issues. We deploy clustering algorithms to detect patterns of activity within our HCM Solution that differ from an organization's normal operating procedures. Referencing these anomalies against the compliance rules relevant to the company, the AI then builds and delivers easily consumable alerts that flag potentially suspicious patterns and the locations in which they take place.




High-level architecture of unsupervised ML process used to uncover compliant patterns and anomalous outliers. Specific metrics like punch time edits, retroactive schedule changes, and deleted punches are transformed into normalized rates comparable across the organization. These rates are then analyzed for reoccurring anomalous or noncompliant behaviors, indicating potential suspicious activity.

### Innovations and advantages gained from detecting anomalous behavior

Figure 4 shows an example of the potentially concerning patterns that can be brought to HR's attention. To get to this level of result requires several key innovations:

Rich metrics – The only way to successfully surface anomalies in time for action is by having enough referenceable numeric data to establish normalized patterns in the first place. We are able capture a far richer level of detail around workforce management metrics than other systems due to over 40 years of experience building solutions in this area of HCM. The detail with which this data is captured allows more successful AI analysis.

Comparison rates – Locations, departments, and other business units vary across an organization, making simple comparison between large and small groups impossible. Instead, the AI uses normalized rates to allow cross-unit comparison against compliance standards and build transparency around how results are found.

Pattern aggregation – A single anomalous edit to a time sheet or even one week of "suspicious" behavior does not necessarily indicate a compliance or fraud issue, though it may be the start of one. For this reason, the AI focuses on detecting subtle, longer-term trends using a monthly aggregation of metric rates and long-term history (typically a year of data) to analyze for trends. This ensures that there is a reasonable degree of certainty when anomalies are surfaced to HR.

The overall advantages of tackling noncompliance and other anomalous behaviors in this way include:

Organization-wide analyses that truly consider both the full scope of the company and the nuances of particular departments when managing compliance

Battle-tested metrics and normalized rates that indicate noncompliance and can be easily compared across units

AI-detected patterns that both show an overview of abnormal behaviors surfaced and provide targeted information on which specific units the behaviors are originating from to facilitate swift, accurate action.

### Testing and delivery

The anomalous behavior detection strategies discussed above have been tested on customers across a variety of industries and have been verified through deployment in multiple products. Testing revealed several important patterns and use cases, including:

Managers subtly manipulating punches (changing only a few minutes here and there), resulting in reduced penalties or overtime

Managers manipulating schedules after the fact (to cover up for employees who leave early or late) to avoid organizational penalties

Pay code edits performed by certain managers who were entering incorrect pay annotations on timecards due to lack of training

## AI FOR MANAGERS AND EMPLOYEES

The various AI approaches discussed in this paper all have a single common thread – the benefits they bring to managers and employees, including HR, through their prioritization of retention, employee experience, personalized HR, and compliance. With these processes in place as part of a unified HCM system, managers and HR can support and have proactive conversations with different teams across an organization while also having their needs anticipated around common processes. On the other side of the coin, employees get transparency into how their performance, productivity, engagement, and other factors are measured, get their needs anticipated as well through proactive contact from management and HR, are protected from compliance violations and suspicious activity, and overall see constant, proactive improvements to their experience at the organization.

## CONCLUSIONS

This paper has identified the approach to AI and ML in HCM. This approach includes the AI best practices of matching specific AI solutions to business problems, innovating by combining AI processes with industry knowledge, testing models on real data, and delivering understandable and actionable results.

In addition, AI advantages in specific areas were covered: handling the full breadth of employee life cycle data within the HCM architecture, applying industry knowledge, and testing in collaboration with customers. The case studies highlighted these advantages and showed how supervised ML automates flight risk detection, how optimization and preference learning can have dual benefits for both the employee experience and HR process personalization, and how unsupervised ML can detect anomalies and outlier behaviors to help mitigate compliance risk and suspicious or fraudulent actions.

AI and ML hold great promise for driving strategic HCM processes, but there is no “magic algorithm” that can solve every single people-related issue. Instead, as the examples in this paper have shown, AI offers both tools that can align with business problems and knowledge that unlocks the potential of an organization’s people data. We are leading the way in applying these techniques correctly and strategically and in building an extensible AI framework that applies the correct processes to address key issues across the entire employee life cycle.