Machine Learning, Algorithms and Predictive Intelligence.

Confluence of words forms sentences, their mentation generates thoughts, and great thoughts throughout our history helped to shape nations and build civilizations but poor thoughts can distort reality and even lead to calamity. With this **philosophical** note, I let you wonder for an instant, but begin to think *on how intelligence can be artificial ? Or how reality can be augmented ?*

Our reality is not a malleable object to be augmented and if intelligence is artificial, then immediately it ceases to be real. Therefore, it is important to be coherent in the conjunction of words and reflect if it is reasonable to combine words like machine and learning.

What is Predictive Intelligence ?

Predictive means being able to announce in advance future events or results. **Intelligence**, it is the ability to acquire and apply knowledge. Predictive Intelligence seems to be an advanced form of intelligence capable of predicting the future. It sounds like we are living in a time where an **Intelligence Alpha** is predicting the formation of neurological diseases and instantly cures it through electrical impulses. Well that's not the case.

In present times, we have technologies capable of foreseeing possible future results and making decisions based on complex algorithms.

Before we see **ServiceNow's PI**, let's have some fundamental understanding of machine learning and see how do algorithms work ?

Machines are using Algorithms to accomplish a given task and provide in the end an output, for example : **Euclid Algorithm** is used to find the greatest common divisor of two numbers. For forecasting, machines are using specific algorithms, most of them origined from advanced mathematical formulas. They can be useful to calculate the most probable near future event based on a model.

Algorithms consume the data to build the best function.

Predictions
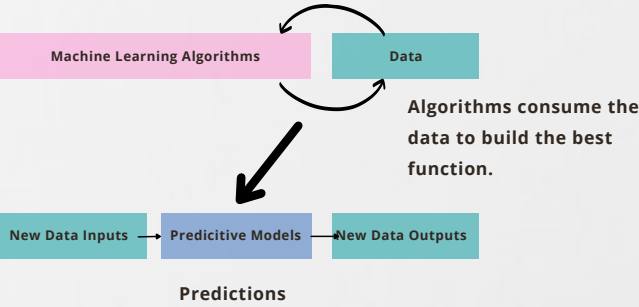
A machine learning application is using **frameworks,** it assumes for a dataset, there is a unknown probability of distribution, the main work of algorithm is to create a function which can represent a strong relation between variables, and there are a series machines learning techniques (Regularization, Risk Minimization, Cross Validations etc..) which can be used to evaluate and validate the model. More often, these techniques are highly dependable on advanced mathematical theories, specifically in the domain of statistics. Each learning algorithm encodes specific assumptions about how the optimal classifier looks like, and works best when this assumption is satisfied by the problem to which it is applied.

The formula or target function is the **model** and it will be used to forecast outcomes for new data points. From the moment you have the right model, the entire process can be fully automated.

Machine learning algorithms do programmatically find the best function, and it is based on some assumptions, they are not inventing formulas. Chatbots evolved from basic conversation to human level conversation, because the application continuously consumed a substantial amount of data, which helped the application to maintain a legitimate predictive model.

For a better predictive model, we need to implement better algorithms, and that means, we need scientists and researchers to come up with better mathematical theories or machine learning algorithms suited for predictions.

Here a list of common algorithms classified by their origin or foundation :

Statistics
Regression (Linear, Logistic, Logit, Binomial, Polynomial,Probit)
Support Vector Plane (SVP) is used for classification, and finds a hyperplane that separates two classes of data points by the largest distance.
Independent component analysis (ICA) is a statistical and computational technique for revealing hidden factors that underlie sets of random variables, measurements, or signals.
Decision tree : An example of Decision Tree is ID3 Algorithm, it is actually based on many statistical concepts such as Entropy and the Kullback–Leibler divergence.
Random Forest - An Assembly of decision trees.
PCA falls into multivariate analysis. It is commonly used for dimensionality reduction by projecting each data point onto only the first few principal components to obtain lower-dimensional data while preserving as much of the data's variation as possible.
Nonparametric Statistics
k-nearest neighbors algorithm (k-NN)
Probability Distribution
Naive Bayes : Bayes' theorem
Probability
K-means clustering is a method of vector quantization, this is a classical quantization technique from signal processing that allows the modeling of probability density functions by the distribution of prototype vectors
Linear Algebra
The singular value decomposition (SVD) is a factorization of a real or complex matrix.Mathematical applications of the SVD include computing the pseudoinverse, matrix approximation, and determining the rank, range, and null space of a matrix. These algorithms can be used interchangeably, you can opt to create a **linear regression model,** subsequently you can use a **lean mean square algorithm** to optimize your predictive model. What is important here, it's the end goal.

In general, you can use algorithms for regression (predict values), anomaly detection (find unusual occurrences), clustering (discover structure) and classification (predict categories). See below how servicenow's predictive intelligence frameworks are deployed at scale.

ServiceNow's PI frameworks at scale
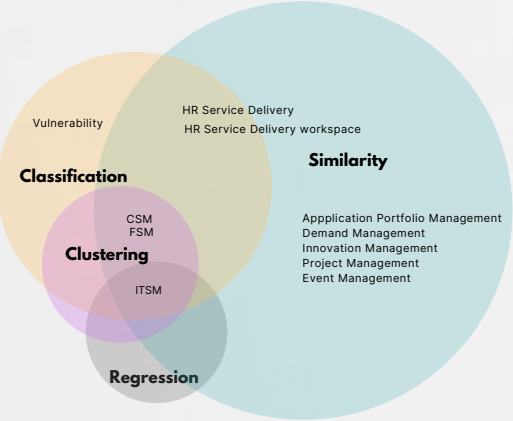
Majority of ServiceNow products are covered by similarity framework followed by classification, regression and clustering. You can use PI to classify new records, for example automatically assign incident category based on short description, group incident records and find patterns, estimate the time it takes to resolve an incident, compare existing records to new similar records for recommending the same solution.
Predictive Analytics has a much wider scope, it is extensively used in healthcare, sports, marketing, fraud detection, law enforcement, retail, manufacturing, financial services etc..

The purpose of this article is to have first a good conceptual understanding of machine learning, then dig little deep to know the foundation for each algorithms and finally identify where servicenow stands in terms of Predictive Intelligence offering.

What is E-signature ?

E-Signature is a scoped application which can be used to send documents for signature. User can route managed documents, KB articles or HR templates for signature. In order to sign the document,the signee can either type his **name**, use his **credentials** or draw a personlised **e-signature.**

In the first instance, we have to create the E-Signature template, below you have a list of points to consider when you complete the e-signature template form.

- E-Signature template name
- E-signatures are meant to be used in a task form, so we mention which task table that we should use for this template. **Here w**e **use HR task.**
- There are 3 E-Signature document types : HR templates, Managed Documents, or Knowledge Articles, **we are using here Managed Documents.**
- *There are 3 E-signature types: Acknowledgment (user just approve the task). Credentials (The signee signs the document with his credentials). Signature(Signee type or draw his signature), for our example we select e-signature*
- *The last one is the Acknowledgment text, we can add a check box with some text that the signee must select before signing the document, but for our example, we set it to false, we don't need any acknowledgment text.*

Note : Prior to create to the template, we must have already a managed document, or a knowledge article or a hr template. Corporate Credit Card Agreement is the managed document that we will be using for our example.

In order to request signatures from users, you can mention the E-Signature template in a task form.
For our example, we create an HR task for an HR Case with the HR task type e-signature and we select the Credit Card Agreement as template, and we also change the state from** draft **to** ready**. See Image 1

Image 1 : High Level View: E-signature - HR Service Delivery and Managed Documents
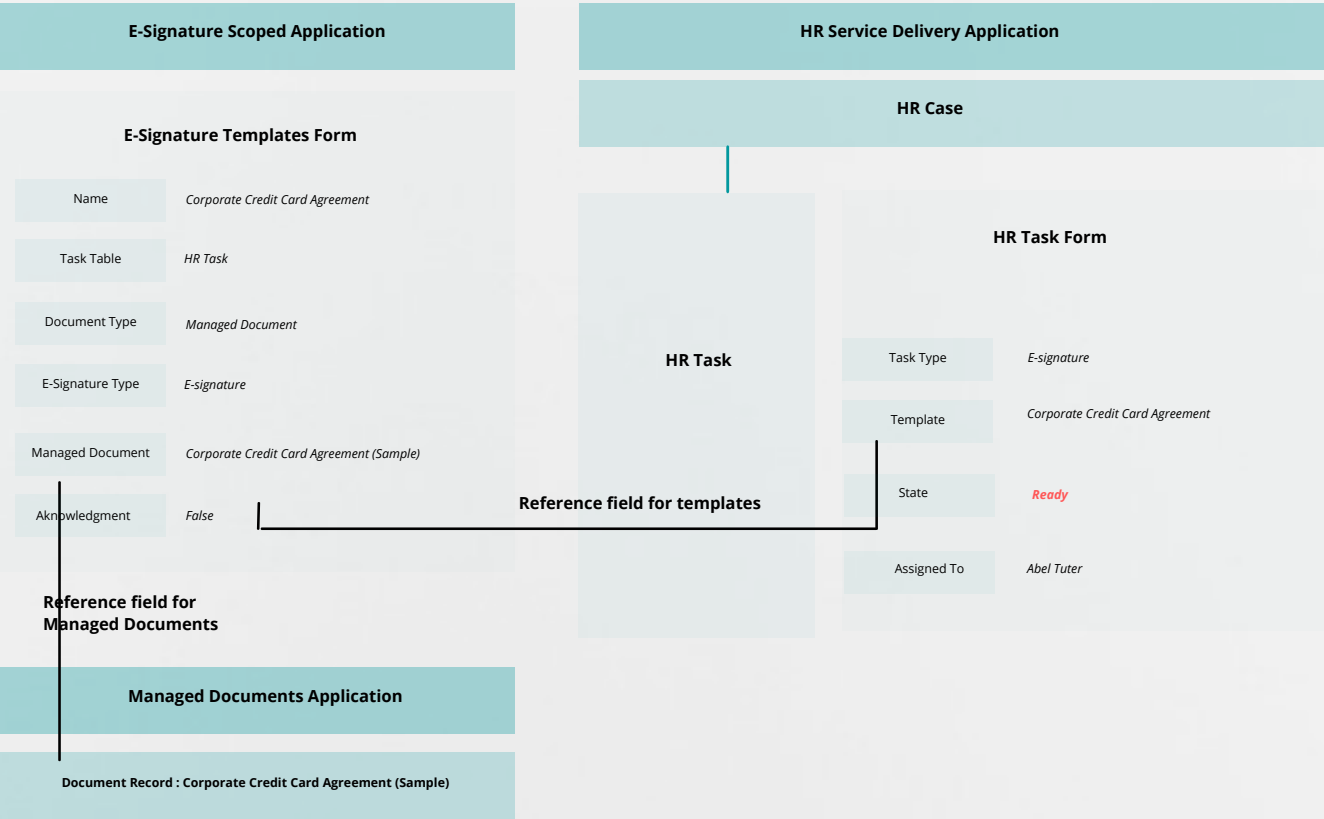
Accept and Complete

The user (*Abel Tuter*) to whom we have assigned the task will receive a notification in their to-do list and this is visible in their employee center portal page. (**See Image 2**) He can approve the task by typing his name or draw his e-signature. After, the approval, the HR task will be automatically closed complete. (**See Image 3**)

Important to notice : The signee can enter his name or any text to move the task from ready to closed complete

Image 2 : Abel Tuter's To-do list in the Employee Center

Employee Center	
	Abel Tuter

My to-dos

Open	Completed	
Corporat...		Pdf Doc

Signature	Abel Tuter	Accept and complete

Image 3 : HR Task State Changed to Closed Complete

HR Service Delivery Application

HR Case

HR Task Form

| HR Task		
	Task Type	*E-signature*
	Template	Corporate Credit Card Agreement
	State	*Closed Complete*
	Assigned To	*Abel Tuter*

Who can create these templates ?

E-signature **Administrator** [sn_esign.admin] and **Manager** [sn_esign.config_manager] can only create these templates.

Analytics for User Experience

Year 2019 servicenow acquired **appsee,** an application which can see user interactions and record it as well, servicenow continued to innovate by combining **Performance Analytics** a mirror42 product and appsee to introduce User Experience Analytics. A full fledged dashboard helping you to understand better your customer digital journey across all devices.

What is
UX ?
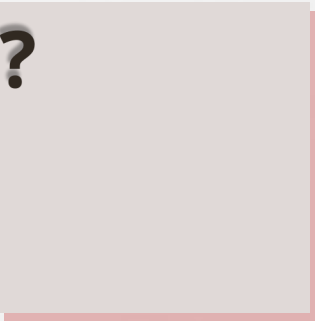
Before we see in details all the features, let's summarize what is User Experience quickly.

UX is a field which is still in process to be defined, in short, the use of UX is helping an organization to redefine an existing digital experience or a physical product by considering multiple criteria, such as user emotion, feel, ability to communicate information efficiently, user belief system, behaviors and preferences. For example, if the context allow, the use of a Brazilian flag in a digital service will lead a greater experience for Brazilian users or whoever is all time fan of **Brazil.** The UX focus is on the pleasure, value and performance while someone is using a product or a particular service. UX is not only making changes to a technical or a visual aspects of a product but it's more about creating a human centered experience.

Now let's see ServiceNow's UX analytics application capabilities.

With the UX dashboard, you can know the number of user, their retention rate, their behavior, see the user flow, you can also have reports on their operating system, session length and geographical locations.

All this information is well organized and split into five different modules

1. The **overview** module contains graphical representation of some important user interaction KPIs, such as number of active users, average sessions by user, average session duration, user activity chart, top session chart, top events, funnel completion and retention bar charts.
2. **Sessions** and **Users** modules contains in a list view detailed information about the users and the sessions, example :reports of loyal users, returning users, long and short sessions, quick abandons, information related to the user devices.
3. **UI Analysis,** is the section where you can see user activity on the User Interface, the module propose various visualizations, pie charts gives you insights about different screens KPIs, reports on pages or screens with the navigation details, pop-ups analytics, common flows and different paths web or mobile app users.
4. **Analytics,** here we gain insights from the application usage pie charts, and we have a world map chart for geographic data analysis, events occurrences, technical reports, and much more in depth analysis on user retention, you will see the average time in between sessions, retention cohort analysis and sessions frequency.

Addition to this features, ServiceNow offers the option to create funnel report and cohort report.

A Funnel report is useful to calculate the conversion rates, it represent the percentage of users who completed a particular task such as searching information, purchasing a product. A funnel analysis helps you to build alternative paths to reach a higher conversation rates.

An Action cohort report shows you the conversation rates over period of time, for example you can measure the percentage of users started a 1st session, came back and started a search for each week.

Working with quantitative and qualitative of your user data allows you to create more intuitive user experience.