SAP Machine Learning and Intelligent Enterprise Roadmap
Bert Laws, Area Product Manager Machine Learning, SAP
Session ID 82247
About the Speakers

Speaker Name

- Bert Laws, SAP
- Area Product Manager, Machine Learning
  10 years at SAP with a background in Performance Management, Financial Solutions Rapid Deployment Solutions and emerging technologies.
Key Outcomes/Objectives

1. Clear understanding of Intelligent Technology tools
2. Understand Side-by-Side vs Embedded delivery models and what this typically means to you
3. View of product roadmaps for content Machine Learning, Conversational AI, RPA, Situation Handling and other Intelligent Technologies over the next few releases
Agenda

• What do we mean by the “Intelligent Enterprise”?  
• Delivery Models  
• Roadmaps
The business problems that SAP Customers are solving

Sales + Marketing
- Churn Reduction
- Customer Acquisition
- Lead Scoring
- Product Recommendation
- Campaign Optimization
- Customer Segmentation
- Next Best Offer/Action

Operations
- Predictive Maintenance
- Load Forecasting
- Inventory/Demand Optimization
- Product Recommendation
- Quality Management
- Yield Management

Fraud + Risk
- Fraud and Abuse Detection
- Claim Analysis
- Collection and Delinquency
- Credit Scoring
- Operational Risk Modeling
- Crime Threat
- Revenue and Loss Analysis

Finance + HR
- Cash Flow and Forecasting
- Budgeting Simulation
- Profitability + Margin Analysis
- Financial Risk Modeling
- Employee Retention Modeling
- Succession Planning

21+ Industries
Examples of business questions and related algorithms

Who will churn, commit fraud, or buy next week/next month?  
**Classification**

How many products will a customer buy next month/next quarter?  
**Regression**

What are the groups of customers with similar behavior or profile?  
**Segmentation**

How much will be the monthly revenue or number of churners next year?  
**Forecasting**

What is the best offer or recommended action for a customer or internet user?  
**Recommendations**

How are the customers and products related to each other?  
**Link Analysis**
SAP S/4HANA – Automated ERP

Intelligent automation using Predictive Technologies and Intelligent User Experience accelerates and improves business processes

- S/4HANA and the Intelligent Suite are foundational to a truly Intelligent Enterprise
- The intelligent enterprise offers a complete and scalable roadmap
- The journey to the intelligent enterprise will be built on next generation business processes
- Leonardo Intelligent Technologies and the Digital Platform are available today
SAP Machine Learning enables the Intelligent Enterprise

**SAP Data**
- 77% of the world’s transaction revenue touches an SAP system
- 26 industries
- 7 lines of business
- The world’s largest business network

**SAP Machine Learning**
- Conversational Experience
- Intelligent Apps
- Digital Platform

**Business Outcomes**
- Increase revenue
- Re-imagine processes
- Enhance productivity
- Satisfy customers
- Enabling innovations
Machine Learning embedded in SAP Applications

70+ new intelligent scenarios planned between now and the end of the year*

*Subject to change
### How are Intelligent Technologies Delivered?

<table>
<thead>
<tr>
<th>Embedded ML</th>
<th>Side-by-Side ML</th>
</tr>
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<tbody>
<tr>
<td><strong>Capabilities</strong></td>
<td><strong>Criteria</strong></td>
</tr>
<tr>
<td>▪ Data remains in HANA DB</td>
<td>▪ Leonardo ML provides cloud services for scalable and distributed training and inference (Cloud Foundry, Kubernetes)</td>
</tr>
<tr>
<td>▪ Real-time inference (always current and no round-trips)</td>
<td>▪ Support for open source frameworks and algorithms (TensorFlow, scikit-learn, R)</td>
</tr>
<tr>
<td>▪ Large library of ML algorithms (90+), TensorFlow integration via EML</td>
<td>▪ Pre-trained models for certain business use cases</td>
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<tr>
<td>▪ Accessible via standard development tools</td>
<td>▪ Access via standard REST API</td>
</tr>
<tr>
<td>▪ Complexity can be hidden in view and table functions</td>
<td>▪ Algorithms and pre-trained models for working with unstructured data / fuzzy data (image, audio, video, text…)</td>
</tr>
<tr>
<td>▪ Integrated with ABAP management and transport system</td>
<td>▪ Deep learning algorithms</td>
</tr>
<tr>
<td>▪ Inherited privacy and security features</td>
<td>▪ GPU support</td>
</tr>
<tr>
<td>▪ Model management</td>
<td>▪ Model management</td>
</tr>
<tr>
<td>▪ Model performance monitoring and automated re-training</td>
<td>▪ Training infrastructure</td>
</tr>
<tr>
<td>▪ Streaming (clustering and classification)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Criteria</strong></th>
<th><strong>Capabilities</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Business &amp; ML logic reside in the SAP S/4HANA Platform</td>
<td>▪ ML logic resides in the SCP Platform while the business logic can be based on SAP S/4HANA or SCP</td>
</tr>
<tr>
<td>▪ Simple use cases like forecasting or trending where the algorithms have low demand for data, RAM and CPU time</td>
<td>▪ Complex use cases like image recognition or natural language processing where among others neural networks with high demand for data, RAM and CPU/GPU time</td>
</tr>
<tr>
<td>▪ Data located in SAP S/4HANA is sufficient for model training, no need for huge external data for training</td>
<td>▪ Huge volume of external data is required for model training, main focus on processing unstructured data</td>
</tr>
<tr>
<td>▪ Required algorithms is provided by SAP HANA ML (e.g. PAL, APL, Text Analysis) and handled by PAI in terms of ML model lifecycle management and ABAP</td>
<td>▪ Required algorithm is not provided by SAP HANA ML, e.g. third party libraries</td>
</tr>
</tbody>
</table>
### Marketing
- **Personalization:**
  - Product Recommendation
  - Offer Recommendation
- **Intelligent Scores:**
  - Channel Affinity
  - Best Email Sending Time
  - Contact Engagement Score / Account Engagement Score
  - Sentiment Engagement Score
  - Customer Behavior: Consumer Buying propensity
  - Performance: Customer Attribution
  - Customer Journey Insight

### Commerce
- **Personalized Customer Experiences**
- **Contextual Merchandizing**
- **Context-Driven Services**

### Sales
- **Imaging Intelligence**
- **Sales Automation (C4C)**
  - Opportunity Scoring
  - Lead Scoring
  - Account Insights
  - Configure Price Quote (CPQ)
  - Price Optimization
  - Up-sell & Cross sell Recommendations
  - Configurations Recommendations
  - Intelligent Sales Execution (Datahug)
  - Relationship Intelligence
  - Deal Intelligence
  - Pipeline Management
  - Predictive Forecasting
- **Commissions**
  - Incentive Optimization
  - Intelligent Coaching
  - Sales Capacity Planning

### Service
- **Ticket Intelligence:**
  - Jam Articles Recommendations
  - Ticket Classification & Entity Extraction NLP
  - Estimated Time to Completion
- **Virtual Assistant „Answer Bot“**
- **Field Service Intelligence**
  - Service & Parts Recommendation

### Q2/2019
- **Commerce**
  - Enterprise Chatbot
- **Sales**
  - Commissions
  - Sales Capacity Planning
- **Service**
  - Ticket Intelligence:
    - Ticket Routing Completion
    - Spam Classifier
  - Solution Intelligence:
    - Email Template Recommendation
    - Responses Recommendation
    - KB Article Recommendation
  - **Field Service Intelligence**
    - Service & Parts Recommendation

### Beyond Q2/19: Product Direction
- **Marketing**
  - Customer Behavior:
    - Lead Conversion Propensity
    - Customer Retention
  - **Sales**
  - **Service**

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Machine Learning for the Digital Core
Product road map overview – Key innovations

Recent Innovations

Finance
- Cash Application
  - Receivables Line Item Matching
  - Payment Advice Extraction
  - Lockbox Line Item Matching
  - Payables Line Item Matching
- SAP Tax Compliance
- SAP Business Integrity Screening
- Financial Account Reconciliation
- SAP Real Spend
- SAP Financial Statement Insights

Sales
- Sales Quotation
- Sales Performance
- Delivery Performance

Natural Language Processing:
- Manage Sales Contracts
- Manage Sales Orders
- Manage Sales Quotations
- Track Sales Orders
- Manage Credit Memo Request
- Manage Debit Memo Request
- Manage Sales Orders without charge

Procure
- Quantity Contact Consumption
- Cash Discount at Risk
- Creation of New Catalog Item
- Propose Material Group
- Reduce Off Contract Spend
- Predict Delivery Date for Purchase Order

Natural Language Processing:
- Smart Buying

Idea
- Project Cost Forecasting
- Digital Content Processing

Natural Language Processing:
- Manage Projects

Produce
- Stock In Transit
- Demand-Driven Replenishment

Service
- Automated Email and Service Request Category mapping

Digital Support Experience with Natural Language Processing
- Create Feature Request
- Create Support Incidents
- Contact Key User
- S-User Management
- Advanced Search
- Show My Support Incidents

Transport Management with Natural Language Processing
- Manage Freight Agreement

Q2/2019

Finance
- Detect Abnormal Liquidity Items
- Intelligent Accrual recommendation

Procure
- Intelligent Approval Workflow

Idea
- Variant Configuration analytics for configuration data – Top Seller

Produce
- Early detections of slow and non moving stocks

Master Data Management
- Business Rule Mining
- Smart Default Values

SCP Enablement
- Automatic Floor Plan Extraction

Service
- Configuration optimization based on load in Convergent Charging

Beyond Q2/19: Product Direction

Finance
- Cash Application for FICA

Procure

Idea

Produce

Service
Machine Learning for Manufacturing & Supply Chain

Use Case Portfolio for Digital Supply Chain

Recent Innovations

Intelligent Asset Management
- Predictive Maintenance & Service
  - Machine Failure Prediction
  - Unnormal Machine State Detection
  - Failure Mode Analytics
  - Extensibility of ML Engine through custom algorithms

Digital Manufacturing
- Predictive Quality Management
  - Defect Detection
  - Extending Defect Detection with machine data
  - Resource Orchestration
  - Auto Dispatch - Preload Resource allocation

Supply Chain Management & Logistics
- IBP
  - Demand Sensing (Leveraging pattern recognition techniques to create short term forecast on a daily basis)
  - Custom Alerts with Machine Learning based Outlier Detection
  - New Forecasting Algorithm

Q2/2019

Intelligent Asset Management
- Predictive Maintenance & Service
  - Life Indicator Forecasting
  - Leading Indicator Analytics

Digital Manufacturing
- Predictive Quality Management
  - Defect detection – improvement data preprocessing
  - Resource Orchestration
  - Auto Dispatch - Preload Resource allocation Enhanced with User Interface

Supply Chain Management & Logistics
- IBP
  - Anomaly detection in Batch Jobs

Beyond Q2/19: Product Direction

Intelligent Asset Management
- Predictive Maintenance & Service
  - Fingerprint Analytics using anomaly detection
  - Configuration Correlation Analysis
  - Asset Manager
  - Measure recognition and equipment recognition via object detection
  - Asset Strategy and Performance Management
  - Cost-sensitive Asset Maintenance Strategy optimization
  - Plant Maintenance (PM) / Execution
  - Failure Mode Suggestion for Workorders/Notifications
  - Intelligent Work order ranking
  - Notification/Alert deduplication based on ML-techniques
  - SAP Newton
  - Predictive Engineering Insights
  - Frequency diagnostics for rotating equipment

Digital Manufacturing
- Predictive Quality Management:
  - Golden batch- Anomaly detection

Supply Chain Management & Logistics
- IBP
  - New Product Introduction
  - Decision Support for Alert Handling
  - Job scheduling optimization
  - Anomalies Detection in Master Data
  - Forecast Level Optimization
  - Natural Language Processing via CoPilot
  - Extended Warehouse Management (EWM)
  - Intelligent Fixed Bin Strategy

Warehouse Insights (WI)
- Warehouse Shift Planning including What-if analysis
- Maximum Working Capability Analysis for Resource Type
- Intelligent Optimization Settings for Warehouses

Transportation Management (TM)
- Automatic Transit Time Adjustment
- Real Cost Tour Planning
- Intelligent Transportation Cockpit

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## Machine Learning for the Industry-specific solutions

### Product road map overview – Key innovations

#### Recent Innovations

**Retail**
- SAP Customer Activity Repository
- Assortment Planning - Optimization
- Assortment Planning - Pre-pack optimization
- Assortment Planning – Store Clustering
- Product Similarity Scoring
- Unified Demand Forecast
- Forecast based Promotion Mgt.
- Promotion Management – Affinity Analysis
- Allocation Management: Cross-product allocation
- Merchandising Mgt.-ML integration to Global Data Synchronization

**Consumer Products**
- Demand Signal Mgt. – Data Quality Service

**Telco**
- SAP Big Data Margin Assurance
- Customer Profitability Analytics

**High Tech**
- SAP Sourcing Simulation and Optimization
- Intelligent Negotiation Engine

**IM&C**
- SAP Product Configuration Intelligence
- Popularity of option (API SCP Service)
- Intelligent Product Selection Engine

**Retail**
- SAP Customer Activity Repository
- Assortment Planning – Decision Support
- Cloud Sales Transaction Serv
- POS Data Transfer and Audit

**Utilities**
- Cloud for Energy – Smart Meter Data Analytics in Utilities
- Customer Profitability Analytics in Utilities

**Professional Services**
- CoPilot Project Managers and Consultants Skill

**Beyond Q2/19: Product Direction**

**Retail**
- 164 ICD CI SCDP Store Replenishment
- Cost Optimal Ordering

**Utilities**
- SAP S/4HANA IS Utilities
- Implausible Meter Readings
- Outsorted billing documents

**IM&C**
- SAP Project Manufacturing Management and Optimization – Intelligent Cross Project Parts Exchange

**Automotive**
- JIT Call Validation (SAP S/4HANA Cloud for Discrete Manufacturing)

**Public Sector**
- Behavioral Insights OD 1.0
- Tax Services with ML
Machine Learning for People Engagement

Product road map overview – Key innovations

Recent Innovations

**SAP Fieldglass Solutions**
- Resume Matching
  - Job seeker resume ranking
- Job Matching
- Job Standardization
- Sign-On assistant
  - Chatbot to help with sign on support

**SAP SuccessFactors Solutions**
- Job Analyzer
- Learning Recommendations
- HR Digital Assistant (Beta)
- HR Ticketing Intelligence (Beta)

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**SAP Fieldglass Solutions**
- In-app assistant
  - Chatbot to guide users to the relevant pages and help perform common actions (Leverages SAP Conversational AI)

**SAP SuccessFactors Solutions**
- Career Path Recommender
- People Like Me

Beyond Q2/19: Product Direction

**SAP Fieldglass Solutions**
- Job matching in candidate portal
  - Provides a seamless way for candidates to connect with opportunities and helps customers engage qualified candidates faster
- Resume Matching
  - Extend resume ranking to help hiring managers and recruiter suppliers
  - Recommend similar candidates to hiring managers and/or recruiters based on the selected candidate’s profile.
- Job Standardization
  - Supplementing job details with O*NET codes to provide richer guidance and KPIs

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**SAP SuccessFactors Solutions**
- Machine Learning for People Engagement

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## Machine Learning for Network & Spend Management

### Recent Innovations

<table>
<thead>
<tr>
<th>SAP Ariba Solutions</th>
<th>Supplier and Risk Management</th>
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<tbody>
<tr>
<td></td>
<td>External Insights</td>
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<td>Supplier Risk Modelling</td>
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<td>Product Classification</td>
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<td></td>
<td>Buy &amp; Make</td>
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<td></td>
<td>Guided Buying - Personalized recommendation and analysis of popular searches (LA)</td>
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<thead>
<tr>
<th>SAP Concur Solutions</th>
<th>Spend</th>
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<td></td>
<td>Concur Detect</td>
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<td>Concur Invoice Capture</td>
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<td>Office 365 Add-in</td>
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<td>Expense Bot</td>
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<td>Concur Locate</td>
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### Q2/2019

**SAP Ariba Solutions**

**Buy & Make**
- Guided Buying - Personalized and item-related recommendations + tiles insights + Reports on GB usage

**SAP Concur Solutions**

**Travel**
- Triplt Voice

### Beyond Q2/19: Product Direction

**SAP Ariba Solutions**

**Source & Contracts**
- Strategic Sourcing & Contracts - External Intelligence
  - News insights and sentiment analysis
- Contract repository enrichment and analytics
- Improve and validate forecast and demand
- Sourcing Recommendation / Semantic Search

**Catalog**
- Catalog-based “quick-release” recommendations + reinforcement learning

**Manage Supplier Relationships**
- Global Business Directory - Supplier deduplication and supplier profile enrichment
- Ontology- Product headword identification for Search in GB, etc. - Improved Search Experience

**SAP Concur Solutions**

**Spend**
- ML Audit (DaVinci)
- Policy Bot
- Concur Travel (expansion from Hiphmunk)
- Increased Expenselt Globalization (Germany, France, Nordics, Japan, Benelux)
Leonardo Machine Learning Foundation and SAP Data Hub available as separate products for machine learning development.

**Development Platform**
- End-to-end development process from data delivery to ML model creation / training / consumption
- Built-in notebook & graphical pipelining environment
- Governance & meta data catalog
- Predefined connectivity, and data preparation / profiling tools
- Specific lifecycle management for ML Scenarios
- Model training & inference with metrics collection, debriefing incl. consumption reporting
- Available as managed cloud service with consumption-based pricing via SAP CP (AWS)

**Business Services**
- Document Information Extraction
- Employee Matching
- Line Item Extraction
- Vendor Matching

**Functional Services:** readily consumable pre-trained models
- Time series change point detection
- Similarity scoring
- Image classification
- Customizable image classification
- Image feature extraction

**Development Platform**
- Automated labeling & annotations of data assets
- Data Lineage and data usage capabilities
- Pre-packaged libraries / content and open extensibility & SDKs
- Operations Dashboard to monitor productive execution
- Enhanced multi-tenancy capabilities including metering
- Deeper integration & connectivity into SAP Enterprise applications like S/4HANA, C/4HANA
- Support for additional hyper-scalers and on-premise deployments with SAP Data Hub

**Further scenarios for Business and Functional services**
- Out-of-the-box ML scenarios automated via Data Pipelines
- Versioning of ML data sets
- Predefined content for e2e business processes
- Delivery of intelligent data applications
- Automated anonymization and verification according GDPR requirements
- Self-learning metadata management
- Semantical data extraction for SAP systems (e.g. SAP S/4HANA, SAP ECC)

**2020 & Beyond: Product Direction**

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SAP Leonardo Conversational AI

Build Skills Faster
- End-to-end bot building collaborative platform with intuitive UX
- Data augmentation — speed up bot training

Powerful — Do the right thing
- World-class NLP and NLP API
- New classification algorithm

Insightful
- Context Management: move from sentence to conversation based bots
- Versioning management

Integrated
- Seamless integration with SAP products
- Automated customer service solutions by industry (available for Telco, banking, insurance, utilities)

Build Skills Faster
- FAQ Document to Skills
- NLG: Macro functions in bot replies

Powerful — Do the right thing
- Hub: Simple dispatch strategy between multiple bots
- Powerful entity detection
  - Multi label detection (cross NER) & Disambiguation
  - Dynamic entry values fetching

Insightful
- Conversation logs
- Emotion detection

Integrated
- Fiori Webchat connected to any bot - UI messages alignments
- Webhook response mapping:
  - map webhook result to message type
  - use code to create dynamic messages

Secure & Enterprise Grade
- SSO: End user authentication
  - from the webchat to the final http request
  - with IDP implementation

DA: Easy Setup
- FIORI 3 visualization adoption

Q2/2019

Build Skills Faster
- Odata skills generation
- Odata service connection
- CRUQ, & mandatory parameters only
- Bot Builder v3: New “atomic & granular” dialog engine
- NLG: Automatic suggestion of bot replies
- Private gallery to re-use content

Powerful — Do the right thing
- Edge cases strategy (no-match, multiple matches) : webhook, ML, rules...
- Remote NER

Insightful
- Live train tips
- New intents from log feed

Integrated
- Odata Middleware: transform odata to http requests

Secure & Enterprise Grade
- Bot delivery
  - Deliver same bot to multiple customers
  - Dataset is customizable by customer
- Enterprise developers account: IDP support for bot developers

Q4/2019

Build Skills Faster
- Full Odata skills generation
- Advanced dialog interactions & New design time
- REST skills generation
- Q&A: Unstructured documents to skills

Powerful — Do the right thing
- ML & context based dispatch
- Action Filtering: Triggers & requirements validation by external system
- Restricted Entity values disambiguation

Secure & Enterprise Grade
- Automatic bot testing: Introduce configurable unit tests for bot
- Multi tenancy

DA: Easy Setup
- Simple Digital Assistant landscape setup: Health check & simplified configuration
- Main config view
  - Skills activation
  - Product version configuration

2020 & Beyond: Product Direction

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### SAP Leonardo Robotic Process Automation

#### Product road map overview – Key innovations

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<tbody>
<tr>
<td>▪ Deliver core framework for Intelligent RPA</td>
<td>▪ Enhance bot building through process recording</td>
<td>▪ Expand bot creation and runtime environment to deepen integration with SAP LoB products</td>
<td>▪ Provide further recording and integration capabilities to cover entire SAP technology portfolio</td>
</tr>
<tr>
<td>▪ Integrate desktop automation scenarios</td>
<td>▪ Integrate cloud runtime for Intelligent RPA</td>
<td>▪ Introduce marketplace for out-of-the-box industry best practices</td>
<td>▪ Conduct PoC for Process Mining/Process Visibility</td>
</tr>
<tr>
<td>▪ Identify S/4HANA automation scenarios</td>
<td>▪ Integrate Conversational AI and Machine Learning</td>
<td>▪ Handle unstructured data for end-to-end automation</td>
<td>▪ Improve bot stability using Computer Vision</td>
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<tr>
<td>▪ Provide connectors for desktop tools, MS office, third-party systems, web applications</td>
<td>▪ Identify SuccessFactors automation scenarios</td>
<td>▪ Identify pre-built content for wider SAP portfolio</td>
<td>▪ Introduce machine learning-based bots for exception handling</td>
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<tr>
<td></td>
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<td>▪ Integrate with SAP Cloud Platform Workflow Service (SAP BPM)</td>
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## Overview: Intelligent ERP Scenarios for SAP S/4HANA 1809 / Cloud 1905

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*More information about SAP Leonardo machine learning foundation: [Product Description](#), [Product Documentation](#)
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