## Workshop Plan: Low-Cost/Free AI Tools Relevant to Manufacturing

This workshop introduces manufacturing professionals to accessible and low-cost/free Artificial Intelligence (AI) tools that can be immediately applied to improve processes, analyze data, and enhance quality control. The focus is on practical application and understanding the potential of AI without requiring extensive coding knowledge or significant investment.

**Target Audience:** Manufacturing engineers, production managers, quality control personnel, data analysts, and anyone in a manufacturing environment interested in leveraging AI.

**Workshop Duration:** [Specify duration, e.g., Half-day (4 hours), Full-day (8 hours)]

**Workshop Objectives:**

Upon completion of this workshop, participants will be able to:

* Identify and understand the potential applications of several low-cost/free AI tools in a manufacturing context.
* Perform basic data analysis and pattern recognition using spreadsheet software with AI add-ons.
* Visually build simple machine learning models for process analysis using Orange Data Mining.
* Train a basic image classification model for visual defect detection using Teachable Machine.
* Understand the fundamental concepts of using Python libraries for more advanced AI tasks and identify pathways for further learning.
* Recognize opportunities to automate workflows and integrate AI using Microsoft Power Automate/Apps with AI Builder.
* Apply learned concepts through hands-on exercises using provided datasets and tools.

**Workshop Structure:**

| Time Allotment | Section | Activity | Tools Covered |
| --- | --- | --- | --- |
| [e.g., 0:00-0:15] | **Welcome and Introduction** | Welcome, workshop overview, objectives, and setting expectations. Brief discussion on the relevance of AI in modern manufacturing. | N/A |
| [e.g., 0:15-1:00] | **Data Analysis with Spreadsheet AI Add-ons** | Introduction to using AI features within Google Sheets/Excel for basic data analysis, forecasting, and identifying trends in manufacturing data. Demonstrations and guided exploration of relevant add-ons/functions. | Google Sheets/Excel with AI Add-ons (e.g., "GPT for Sheets" if applicable, built-in functions) |
| [e.g., 1:00-2:00] | **Visual Machine Learning with Orange Data Mining** | Introduction to Orange Data Mining as a visual tool. Explanation of its interface and basic functionalities. Focus on data loading, visualization, and building simple models (e.g., Decision Tree, Clustering) relevant to manufacturing data. | Orange Data Mining |
| [e.g., 2:00-2:45] | **Hands-on Exercise 1: Process Optimization** | Participants work through Exercise 1, applying Orange Data Mining to analyze a sample manufacturing dataset and identify factors influencing process outcomes. Facilitator provides guidance and support. | Orange Data Mining |
| [e.g., 2:45-3:00] | **Break** |  | N/A |
| [e.g., 3:00-3:45] | **Basic Image Recognition with Teachable Machine** | Introduction to Teachable Machine. Explanation of how to train simple image classification models. Focus on applications in visual inspection and defect detection. Live demonstration of training a model. | Teachable Machine (Google) |
| [e.g., 3:45-4:30] | **Hands-on Exercise 2: Basic Defect Detection** | Participants work through Exercise 2, training their own simple image classification models using Teachable Machine and provided or self-captured images of manufactured parts. | Teachable Machine (Google) |
| [e.g., 4:30-5:15] | **Introduction to Python for Manufacturing AI** | Overview of Python and its key libraries (Pandas for data manipulation, Scikit-learn for machine learning). Discussing more advanced applications and pathways for further learning (online resources, courses). *This section will be an introduction, not an in-depth coding session.* | Python with Libraries (Pandas, Scikit-learn) |
| [e.g., 5:15-6:00] | **Workflow Automation with Power Automate/Apps & AI Builder** | Introduction to Microsoft Power Automate and Power Apps with a focus on AI Builder capabilities. Demonstrating how to automate tasks and integrate AI models (like form processing or prediction) into manufacturing workflows. Discussing licensing considerations (often included in existing M365 plans). | Microsoft Power Automate / Power Apps (with AI Builder) |
| [e.g., 6:00-6:30] | **Open Discussion, Q&A, and Next Steps** | Facilitating a discussion on potential applications within the participants' own facilities. Answering questions and providing resources for continued learning and exploration of the tools and concepts. | N/A |

**Detailed Exercise Plans:**

**Exercise 1: Process Optimization with Visual Tool (Orange Data Mining)**

* **Goal:** To visually explore a manufacturing dataset and build a simple model to identify factors influencing a key process outcome (e.g., product quality, production yield).
* **Tools:** Orange Data Mining.
* **Materials:** A pre-cleaned, sample dataset of manufacturing process metrics (e.g., machine settings, environmental data, raw material properties, quality inspection results). The dataset should be in a compatible format (e.g., CSV).
* **Task:**
  1. **Data Loading:** Participants will load the provided dataset into Orange Data Mining using the "File" widget.
  2. **Data Exploration:** Use visualization widgets (e.g., "Data Table", "Distributions", "Scatter Plot") to explore the data and gain initial insights into the relationships between different variables.
  3. **Model Building:** Introduce simple classification or regression models suitable for the dataset (e.g., "Decision Tree", "Linear Regression" depending on the outcome variable). Participants will connect the data to the model widget.
  4. **Model Interpretation:** Use visualization widgets associated with the model (e.g., "Tree Viewer" for Decision Tree) to interpret the model's findings and identify which input factors have the most significant impact on the outcome.
  5. **Discussion:** Facilitate a discussion on what the model reveals about the manufacturing process and potential areas for optimization.
* **Benefit Demonstrated:** How visual AI tools can quickly uncover hidden patterns and insights in manufacturing data without requiring coding, leading to data-driven decisions for process improvement.

**Exercise 2: Basic Defect Detection with Teachable Machine**

* **Goal:** To train a simple image classification model to distinguish between "good" and "defective" manufactured parts based on visual appearance.
* **Tools:** Teachable Machine (web-based).
* **Materials:** A collection of images of "good" and "defective" manufactured parts. These can be pre-provided or participants can use their smartphone cameras to capture images of sample parts if available. Ensure clear examples of different defect types relevant to a manufacturing context.
* **Task:**
  1. **Project Setup:** Participants will create a new Image Project in Teachable Machine.
  2. **Class Definition:** Define at least two classes: "Good Part" and "Defective Part". More specific defect categories can be added if the image data supports it (e.g., "Scratch Defect", "Misalignment Defect").
  3. **Data Upload/Capture:** Participants will upload the provided images or capture their own images for each defined class. Emphasize the importance of having a sufficient number and variety of examples for each class.
  4. **Model Training:** Train the image classification model using the uploaded image data. Explain the training process in simple terms.
  5. **Model Testing:** Test the trained model using new images of parts to see how accurately it classifies them as good or defective.
  6. **Export (Optional but Recommended):** Show participants how to export the trained model for potential use in other applications (e.g., a simple web page, or integrated with other tools - though full integration is beyond the scope of this basic exercise).
* **Benefit Demonstrated:** The ease of creating a basic AI model for a common quality control task (visual inspection). Participants will understand the concept of training an AI model with data and its potential for automating or assisting with visual inspection processes.

**Materials Required for Workshop:**

* Projector and screen for presentations and demonstrations.
* Internet access for all participants (Teachable Machine is web-based, Orange Data Mining requires download but internet is helpful for resources, Google Sheets/Excel add-ons require internet).
* Computers for each participant with Orange Data Mining installed (or instructions for participants to install it prior to the workshop).
* Access to Google Sheets or Microsoft Excel for participants.
* Sample datasets for Exercise 1 (CSV format).
* Sample images of good and defective parts for Exercise 2. Participants can also use their smartphones.
* List of recommended AI add-ons for Google Sheets/Excel with installation instructions.
* Links to download Orange Data Mining.
* Link to the Teachable Machine website.
* Basic introduction materials to Python, Pandas, and Scikit-learn (links to online resources, documentation).
* Information on Microsoft Power Automate/Apps and AI Builder (links to documentation, relevant examples).
* Workshop slides/presentation material.
* Participant handouts with key concepts, tool summaries, and links to resources.

**Facilitator Notes:**

* Tailor the depth of each section to the participants' prior knowledge and the allotted time.
* Encourage questions and discussion throughout the workshop.
* Provide clear instructions and support during the hands-on exercises.
* Emphasize that these are introductory tools and serve as a stepping stone to more complex AI applications.
* Highlight the low-cost/free nature of these tools as a significant advantage for adoption in manufacturing settings.
* Discuss real-world examples of how these or similar AI tools are being used in manufacturing.

**Post-Workshop:**

* Share workshop materials, datasets, and links with participants.
* Provide contact information for further questions.
* Consider creating a follow-up resource list with tutorials and case studies.

This plan provides a solid framework for a workshop introducing low-cost/free AI tools relevant to manufacturing. Remember to adjust the timings and depth based on the specific needs and experience level of your participants.