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**Milestone 1: Define Problem / Problem Understanding**

**Activity 1: Specify the business problem**

Refer Project Description

**Business Problem:**  
Chronic Kidney Disease (CKD) is a serious health issue that often goes undetected until it reaches an advanced stage. Early detection is critical to prevent kidney failure and reduce treatment costs. Hospitals and healthcare providers need a way to predict CKD in its early stages using patient data. By using machine learning, we can create a system that helps doctors identify CKD risk early, so that treatment can start on time and improve patient outcomes.

**Activity 2: Business requirements**

The business requirements for a machine learning model to predict chronic kidney disease include the ability to accurately predict the ckd based on given information, Minimise the number of false positives (predicting diseased) and false negatives (not diseased). Provide an explanation for the model's decision, to comply with regulations and improve transparency.

To support early prediction of Chronic Kidney Disease (CKD), the machine learning model must meet the following business requirements:

1. **High Accuracy:**  
   The model should correctly predict whether a person has CKD or not using patient data (like age, blood pressure, test results, etc.).
2. **Minimize Errors:**
   * Reduce **false positives** (predicting CKD when the person is healthy).
   * Reduce **false negatives** (predicting healthy when the person has CKD).  
     This helps avoid wrong treatments or missed diagnoses.
3. **Explainability:**  
   The model should provide clear reasons behind its predictions. This helps doctors trust the results and ensures compliance with healthcare regulations.
4. **Support Healthcare Decisions:**  
   The model should be easy to use in real medical settings and assist doctors in making early, informed decisions about patient care.

**Activity 3: Literature Survey (Student Will Write)**

Chronic kidney disease (CKD) is a significant public health issue, affecting an estimated 14% of the global population. The disease is characterized by a gradual loss of kidney function over time, leading to a range of serious health complications, including end-stage renal disease (ESRD) requiring dialysis or kidney transplant. Early detection and management of CKD is crucial to prevent progression to ESRD and improve patient outcomes.

There have been numerous studies in recent years aimed at developing accurate and efficient methods for predicting CKD progression. These studies have employed a variety of techniques, including machine learning, deep learning, and artificial neural networks.

Chronic Kidney Disease (CKD) is a major global health concern, affecting about 14% of the world population. It involves a slow loss of kidney function over time, which can lead to severe complications like End-Stage Renal Disease (ESRD), where the patient may need dialysis or a kidney transplant. Detecting CKD early is very important to prevent its progression and improve the patient’s health outcomes.

In recent years, many research studies have focused on building models to predict CKD at an early stage. These studies have used advanced techniques such as **Machine Learning (ML)**, **Deep Learning**, and **Artificial Neural Networks (ANNs)**. These models aim to analyze patient data (like blood tests, urine tests, age, etc.) to accurately identify the risk of CKD. Research shows that ML models like **Support Vector Machines (SVM)**, **Random Forests**, and **Logistic Regression** have shown good accuracy in predicting CKD.

Such approaches not only help in early diagnosis but also support healthcare professionals in decision-making, leading to better treatment and management of the disease.

**Activity 4: Social or Business Impact.**

On a social level, early detection and prediction of CKD can lead to improved patient outcomes and quality of life. By identifying individuals at risk for CKD, healthcare providers can intervene early and slow the progression of the disease through lifestyle changes, medication management, and other treatments. This can help prevent the need for dialysis or kidney transplantation, which can be costly and life-altering for patients. Additionally, early prediction can also help reduce the overall burden of CKD on the healthcare system by reducing the number of hospitalizations and emergency room visits.

**Social Impact:**  
Early prediction of Chronic Kidney Disease (CKD) can greatly improve the lives of patients. By identifying people at risk early, doctors can provide timely treatment, suggest lifestyle changes, and manage medications better. This can slow down the disease and help patients avoid dialysis or kidney transplant, which are expensive and physically demanding.

**Business Impact:**  
Early detection also reduces the burden on hospitals and the healthcare system. It lowers the number of emergency visits and long hospital stays, saving costs for both patients and providers. Healthcare organizations can use predictive models to plan resources better and offer preventive care, leading to more efficient and cost-effective services.