### **Fundamentals**

* **Generalized Linear Models (GLMs)**: GLMs are a flexible generalization of ordinary linear regression that allows for response variables that have error distribution models other than a normal distribution.

### **Regression and Modeling**

* **Polynomial Regression**: Polynomial regression extends linear regression by adding polynomial terms (squared, cubed, etc.) to the model, allowing it to capture non-linear relationships.
* **Step Function**: A function that increases or decreases abruptly from one constant value to another.
* **Basis Functions**: Basis functions are a set of functions used to represent or approximate other functions. Examples include polynomials, splines, and wavelets.
* **Splines**: Splines are piecewise polynomial functions used to create smooth curves. They're useful for interpolating data and approximating complex relationships.
* **Smoothing Splines**: Smoothing splines are similar to splines, but they aim to approximate the data without necessarily passing through every data point, which is useful for noisy data.
* **Local Regression (LOESS)**: A method that fits a separate regression model to localized subsets of the data, creating a smooth curve by combining these local models.

### **Link Functions**

* **Link Functions**: A link function is a function that connects the linear predictor in a GLM to the expected value of the response variable. Examples include the identity link (for simple linear regression) and the logit link (for logistic regression).
  + **Linear**: η(μ)=μ.
  + **Logistic**: η(μ)=log(μ/(1−μ)).
  + **Poisson**: η(μ)=log(μ).

### **Families**

* **Gaussian (Normal)**: Used for continuous data that is normally distributed.
* **Binomial**: Used for binary data (e.g., success/failure, presence/absence) or count data where the number of trials is fixed.
* **Poisson**: Used for count data where the events occur independently at a constant rate (e.g., the number of customers arriving at a store per hour).
* **Gamma**: Used for continuous positive data that is skewed (e.g., income, waiting times).
* **Inverse Gaussian**: Used for continuous positive data with a specific type of skewness.

### **Other Important Concepts**

* **Maximum Likelihood Estimation (MLE)**: A method for estimating unknown parameters (like the probability of heads in a coin flip) by finding the parameter values that make the observed data most likely.
* **Bayesian Approach**: An alternative to MLE that incorporates prior knowledge or beliefs about the parameters being estimated.
* **Local Minimum**: A point in a function where the function has the lowest value in its immediate neighborhood.
* **Global Minimum**: The absolute lowest point in the entire function.