Statistics plays a vital role in computer vision and data science by providing tools to analyze and interpret data. Here are some fundamental statistics concepts:

1. **Random Variables**:
   * A random variable is a variable whose possible values are outcomes of a random phenomenon.
   * It can be discrete (taking on a countable number of values) or continuous (taking on an infinite number of values within a range).
   * Example: Outcome of rolling a fair six-sided die (discrete) or the height of individuals in a population (continuous).
2. **Mean (Expected Value)**:
   * The mean of a random variable is the average value it takes over many trials.
   * For a discrete random variable �*X*, the mean �[�]*E*[*X*] is calculated as the sum of each value ��*xi*​ weighted by its probability �(�=��)*P*(*X*=*xi*​).
   * For a continuous random variable, the mean is calculated using integration over the entire range of possible values.
   * Example: If �*X* represents the outcome of rolling a fair six-sided die, the mean is �[�]=16∑�=16�*E*[*X*]=61​∑*i*=16​*i*.
3. **Variance**:
   * Variance measures the dispersion of values around the mean.
   * It's calculated as the average of the squared differences between each value and the mean.
   * For a discrete random variable �*X*, the variance Var(�)Var(*X*) is calculated as Var(�)=∑�=1�(��−�)2�(�=��)Var(*X*)=∑*i*=1*n*​(*xi*​−*μ*)2*P*(*X*=*xi*​), where �*μ* is the mean.
   * For a continuous random variable, the variance is calculated using integration over the entire range of possible values.
   * Example: If �*X* represents the outcome of rolling a fair six-sided die, the variance is Var(�)=16∑�=16(�−�)2Var(*X*)=61​∑*i*=16​(*i*−*μ*)2, where �*μ* is the mean.

These statistics concepts provide a foundation for understanding the behavior and characteristics of data distributions, which is essential for various tasks in computer vision and data science, including data preprocessing, feature engineering, and model evaluation.

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