**🔍 Instruction for AI-Agent: Interpreting CANVAS-Derived Spatial Features**

**Objective**:  
Given a spatial feature name (e.g., Ripley\_K\_mean\_Habitat08), the AI agent should output a structured, biologically informed interpretation across multiple dimensions to enhance translational and mechanistic understanding.

### 🧠 ****Input****:

* Feature name (string): the exact name of one of the 262 CANVAS -derived spatial features, e.g., Ripley\_K\_mean\_Habitat08

**📤 Output Structure:**

1. **Category**  
   Identify which of the six major domains the feature belongs to:
   * Composition
   * Diversity
   * Spatial dispersion
   * Interaction
   * Distance
   * Transition
2. **Cellular Composition of Associated Habitat**  
   Describe the dominant or enriched cell types in the corresponding habitat (e.g., H08), referencing known immune or stromal populations:
   * Tcyto, Th, B cell, Plasma cell → immune-activating
   * CAF, Neutrophil, M2 → immunosuppressive
   * EC, DCs, Mono → context-dependent
3. **Spatial Property Description**  
   Explain what the spatial feature measures and what a high or low value indicates. For example:
   * Ripley\_K\_mean: degree of spatial clustering or dispersion across radii
   * Kernel density: local concentration
   * J\_function: spatial regularity
   * Pairwise interaction: proximity-based coupling across habitats
   * STE: entropy-based intermixing
4. **Topological Coupling Tendency**  
   Comment on which other habitats this feature tends to correlate or co-occur with, based on Jaccard proximity, interaction networks, or shared prognostic modules (e.g., H03–H08 co-localization, H01–H04–H06 exclusion).
5. **Biological and Clinical Implication**  
   Synthesize its potential role in:
   * **Immune activation vs. suppression**
   * **Prognostic outcome** (protective or risk)
   * **Predictive relevance to immunotherapy response**
   * Example: High Ripley\_K\_H06 = tightly clustered neutrophilic niche → immunosuppression → poor PFS

**💬 Example Output (for Ripley\_K\_mean\_Habitat08):**

**1. Category**: Spatial dispersion  
**2. Cell Composition**: Habitat 08 is enriched in CD4⁺ T helper and CD8⁺ cytotoxic T cells, often co-localized with B cells (from H03).  
**3. Spatial Property**: Ripley\_K\_mean quantifies the spatial clustering of cells within H08. A higher value indicates stronger intrahabitat aggregation and potential TLS formation.  
**4. Coupling Tendency**: Frequently co-localized with H03 (B cell niche), forming a coordinated adaptive immune module; often spatially distant from H01 (tumor core).  
**5. Clinical Implication**: High clustering of H08 cells reflects robust immune activation and TLS presence, predictive of improved ICB response and longer PFS.