Goal: Identify **new features** for classifying spatial relationships and **improve the graph representation** of the input expression to increase the recognition rate.

**Graph Representation**
- **Build** symbol Line of sight graph (LOS) and Eye – Center of the symbol. Connect symbols visible from it’s eye.
  - LOS graph and final layout tree (green)
- **Eliminate edges** with low confidence in LOS graph, based on visual, geometric and angular features.
  - Filtered graph and final layout tree (green)

**System Overview**
- Build Symbol LOS Graph
- Edge Elimination
- Classify Layout
- Extract Layout Tree

**Features - Edge Elimination & Classification**
Features are extracted between two symbols (parent and child).
- **Visual features** extracted by encapsulating the parent and child in concentric circles, divided into angular bins and find the density of parent, child and other symbol points in the bin.
  - Expression Parent Features (‘=’) Child Features (‘3’) Context (‘x’)

- **Angular features** finds the angular range blocked by the child symbol from the parent symbol’s eye. The features are the lower bound and upper bound.

**Results**
- Dataset used: CROHME 2014

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Layout Recall</th>
<th>Formula Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline [1]</td>
<td>92.4%</td>
<td>61.2%</td>
</tr>
<tr>
<td>Angular features</td>
<td>94%</td>
<td>62.4%</td>
</tr>
<tr>
<td>Edge Elimination</td>
<td>95%</td>
<td>63.7%</td>
</tr>
</tbody>
</table>

**Conclusion**
- Angular Features help in better layout classification.
- Elimination of edges improves the formula recognition rate.

**References**