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High-Level Toolset For Comprehensive Visual Data Analysis And Model Validation

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Scientific visualization – essential part of research

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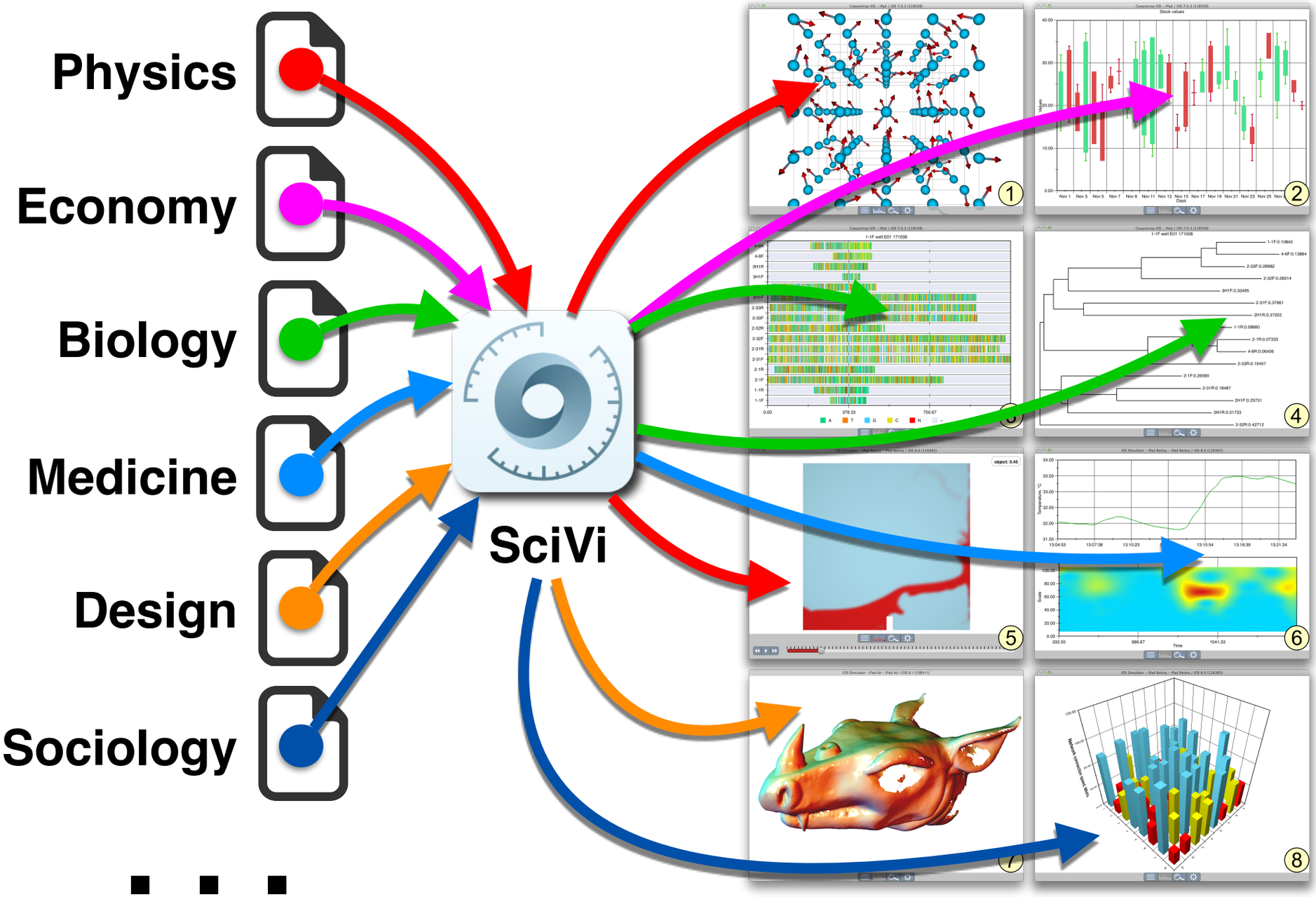
Adaptive tools of
advanced scientific visualization
can be used for
comprehensive and meaningful data analysis

Objective: create an adaptive scientific visualization toolset capable for visual analytics

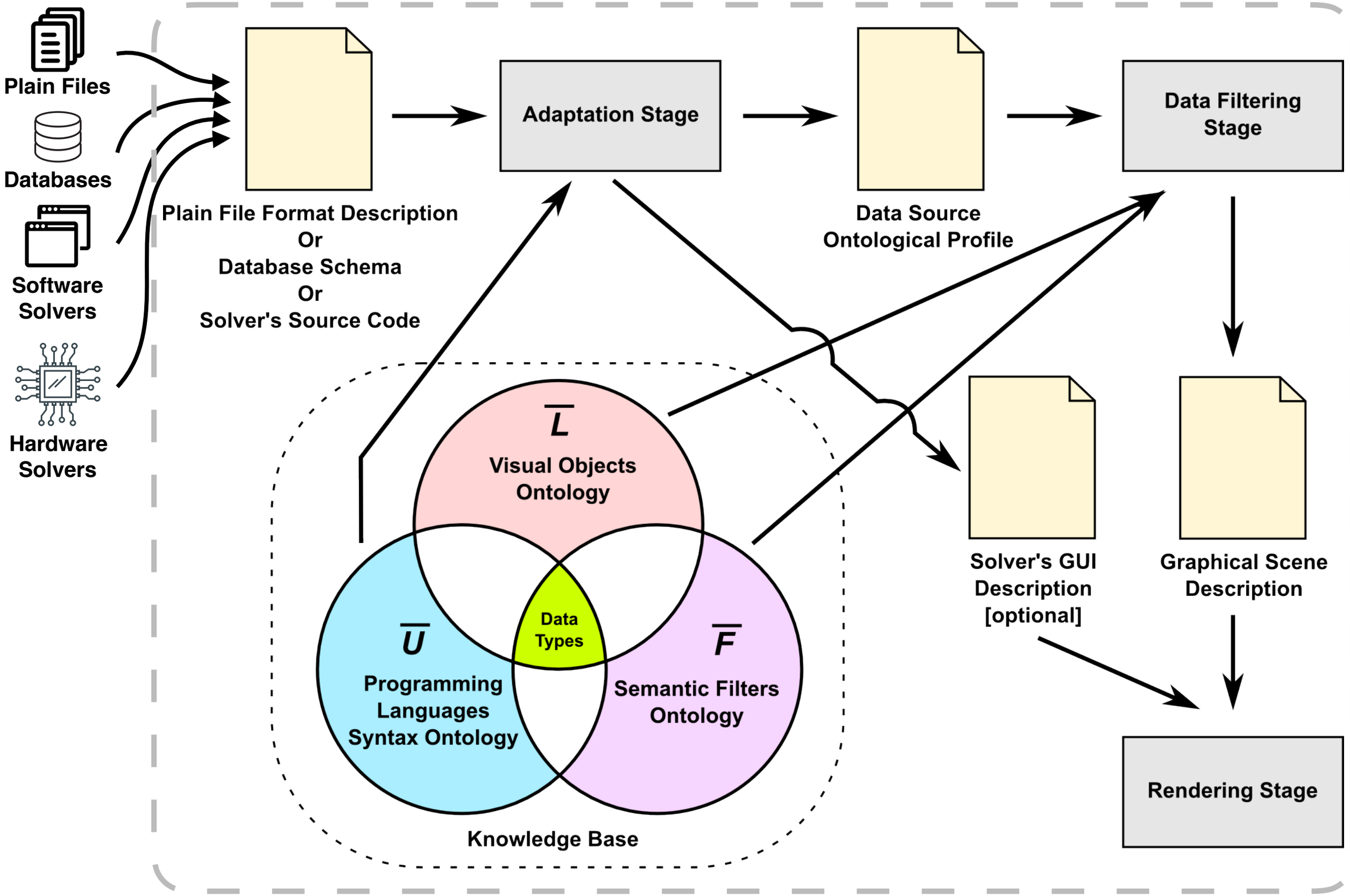
Previous Work

Multiplatform client-server adaptive scientific visualization system SciVi

Ryabinin K., Chuprina S. Development of Ontology-Based Multiplatform Adaptive Scientific Visualization System // Journal of Computational Science. – Elsevier, 2015. – Vol. 10. – P. 370–381



SciVi Pipeline



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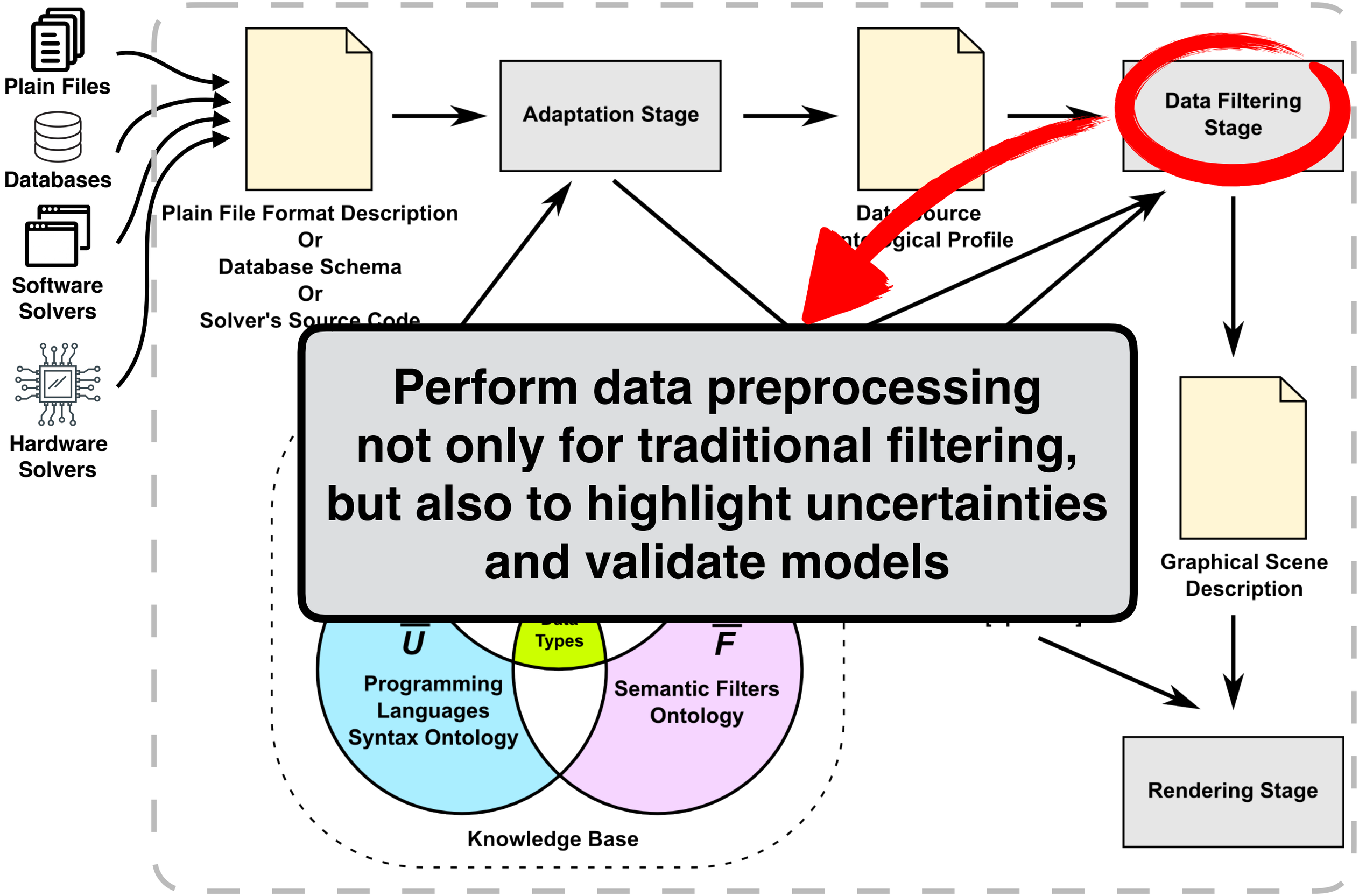
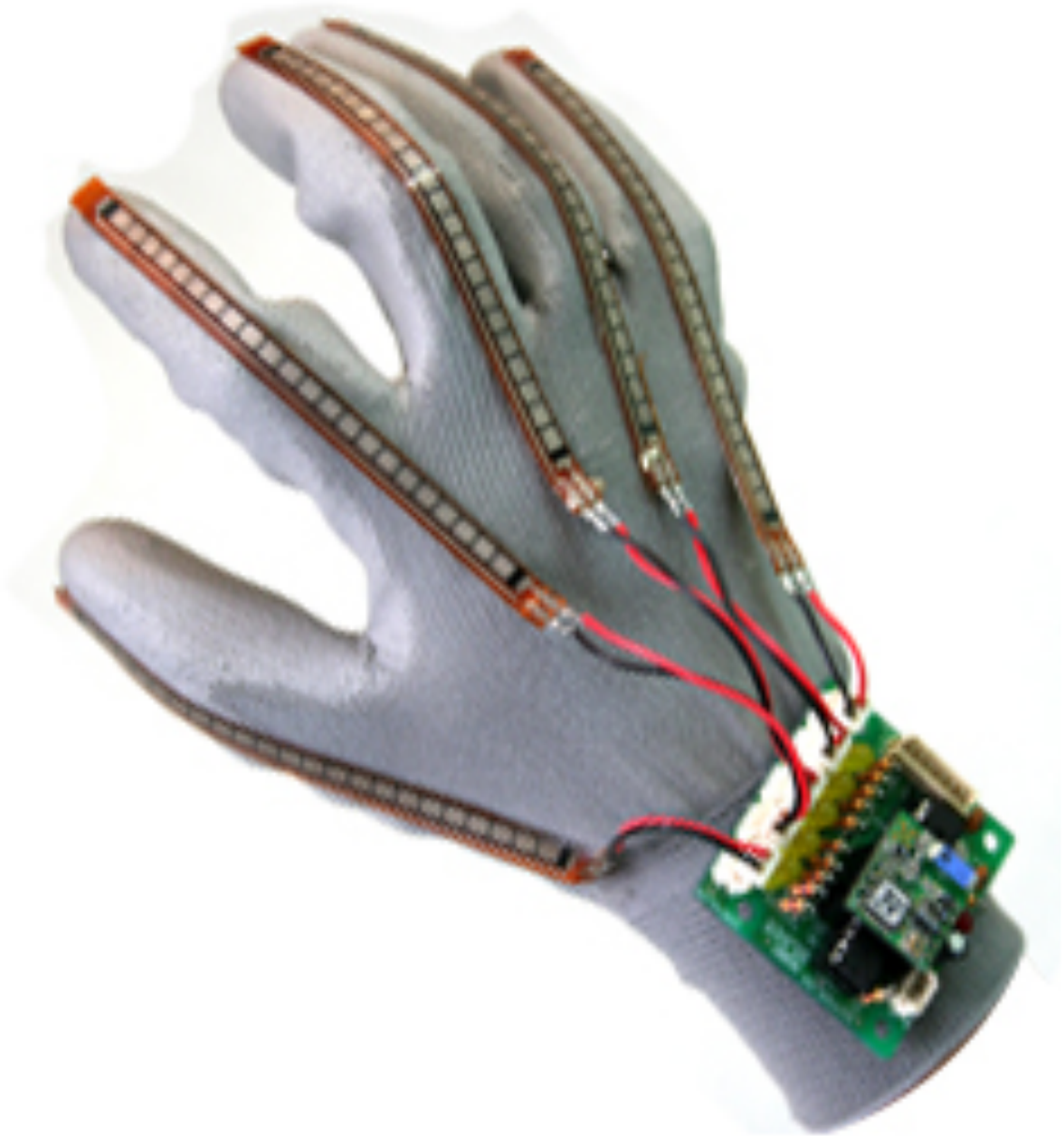


Hardware Solver:
Attitude and Heading Reference System
(Robotics, part of Data Glove)



GY-85 chipset
(9 axis orientation sensor)

Automated Adaptation To Solver

If solvers' source code is available, parser is automatically generated by ontology $\bar{U}$

```
359   }
360
361   void loop()
362   {
363       Orientation angles;
364       g_imu.read(angles);
365
366       Quat cur(angles);
367       if (digitalRead(BUTTON_PIN) == HIGH)
368           g_ref = cur.inverse();
369       cur *= g_ref;
370       angles = cur.orientation();
371
372       g_udp.beginPacket(IPAddress(255, 255, 255, 255), 8080);
373       g_udp.write(&angles.yaw, 8);
374       g_udp.write(&angles.pitch, 8);
375       g_udp.write(&angles.roll, 8);
376       g_udp.endPacket();
377   }
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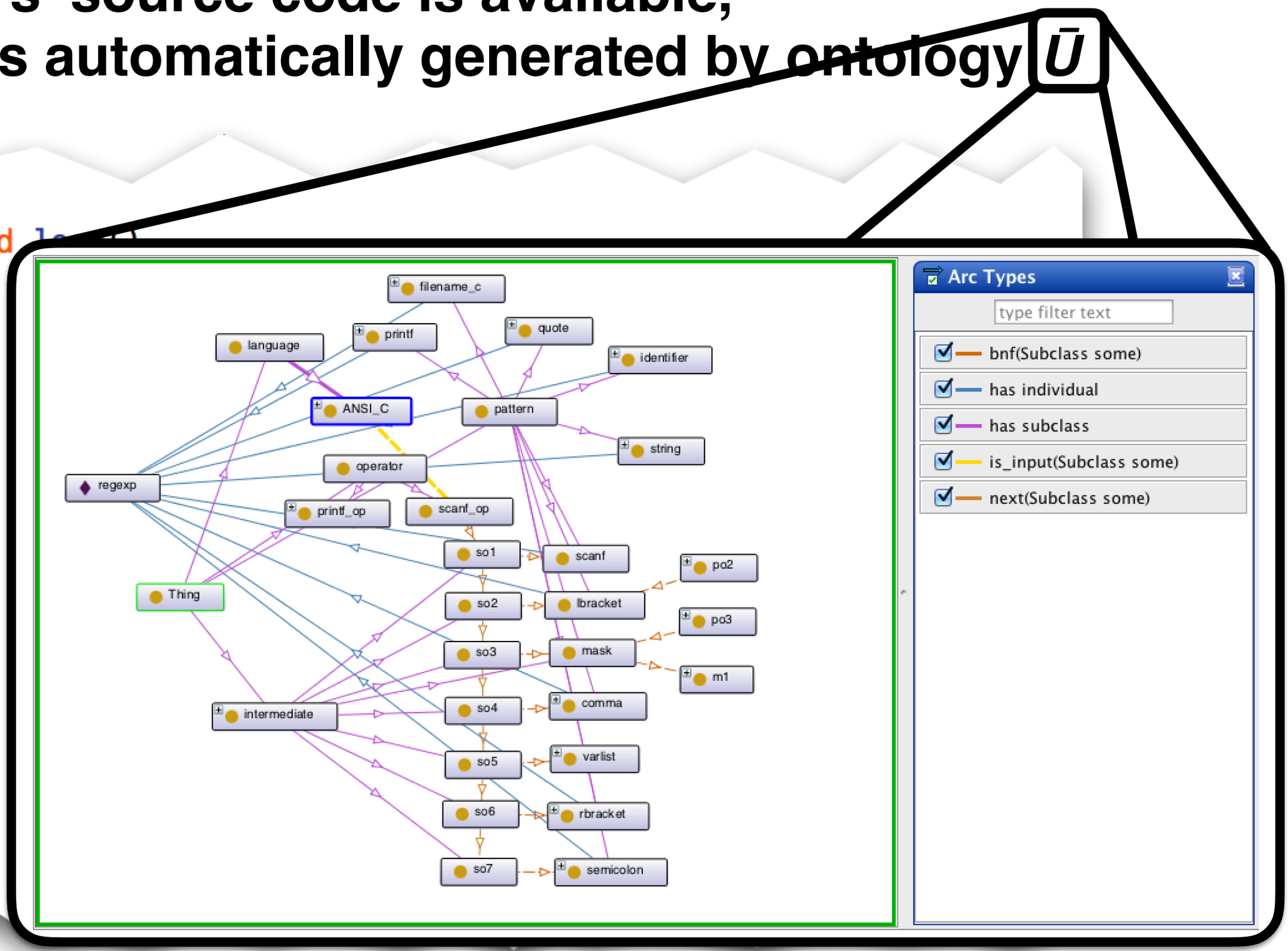

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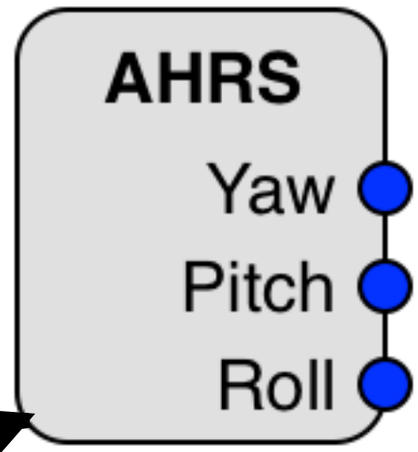
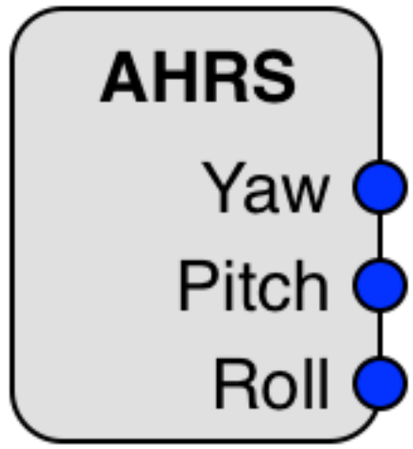


Visualization

Traditional visualization gives 3D model of the hand with the orientation mapped to sensor values



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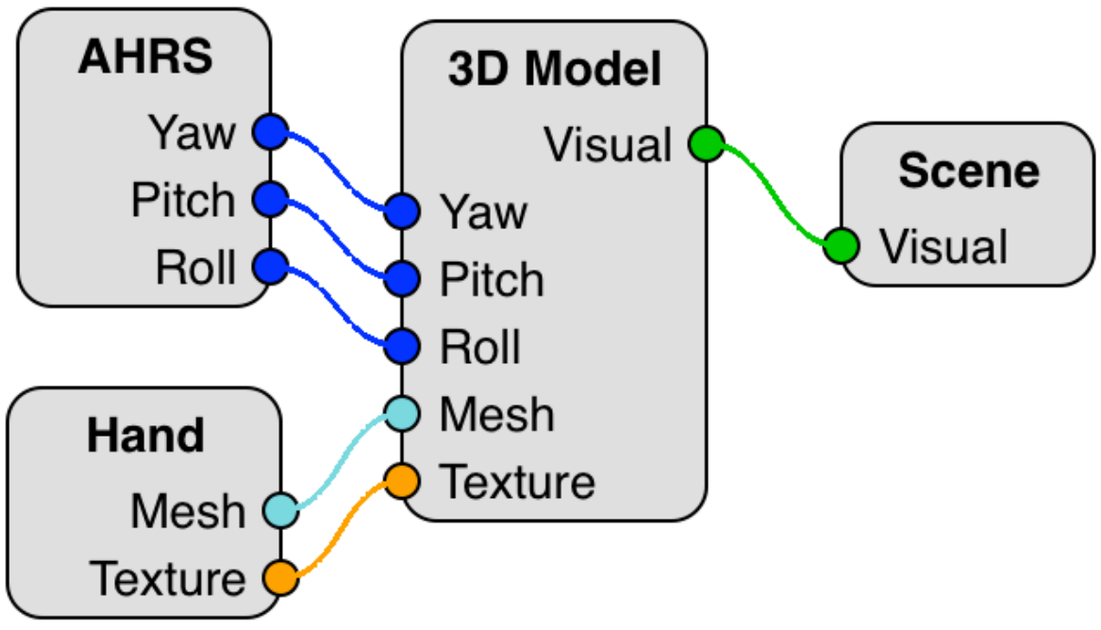

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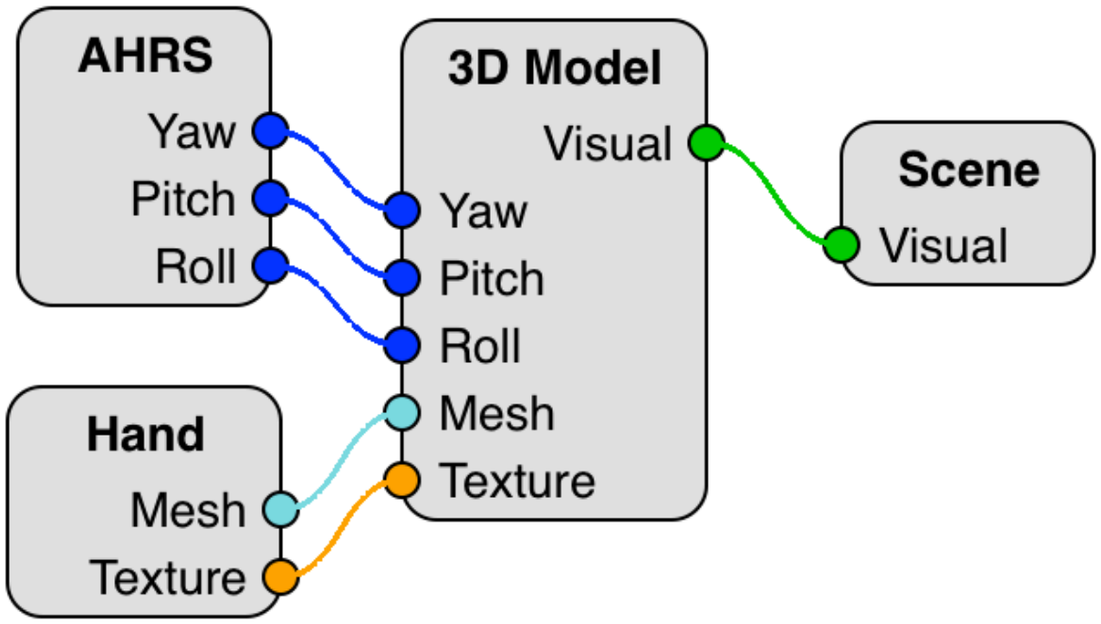

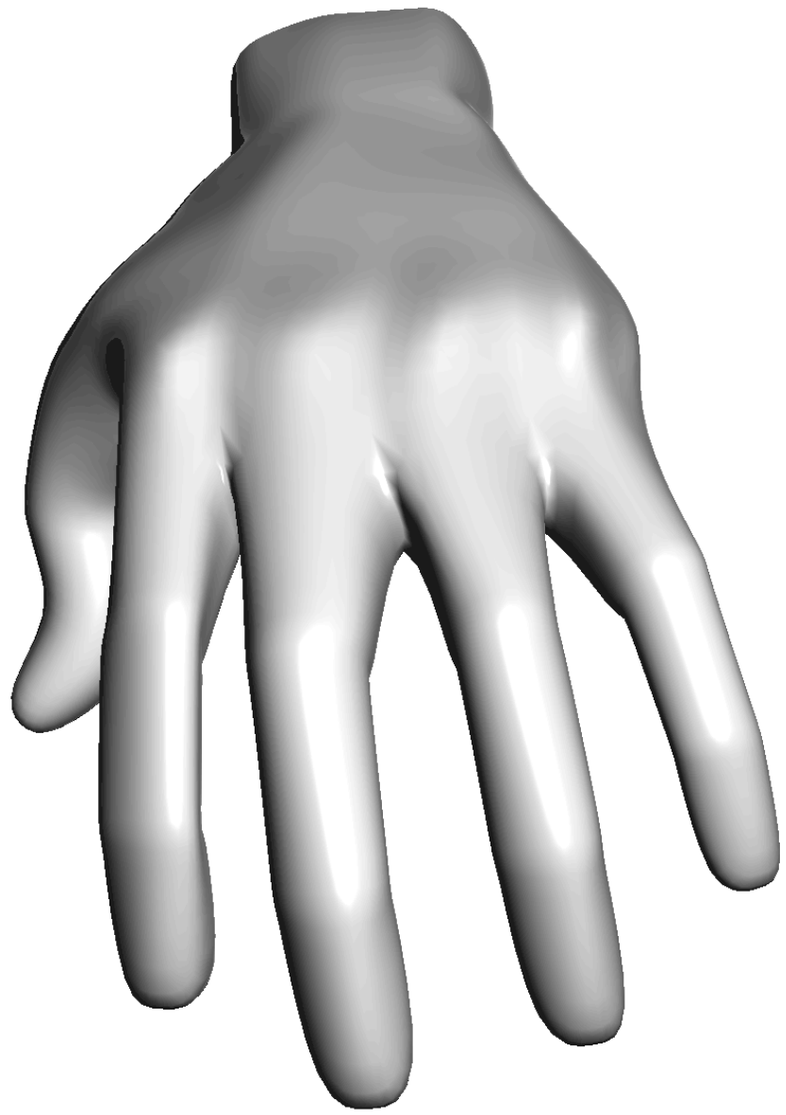

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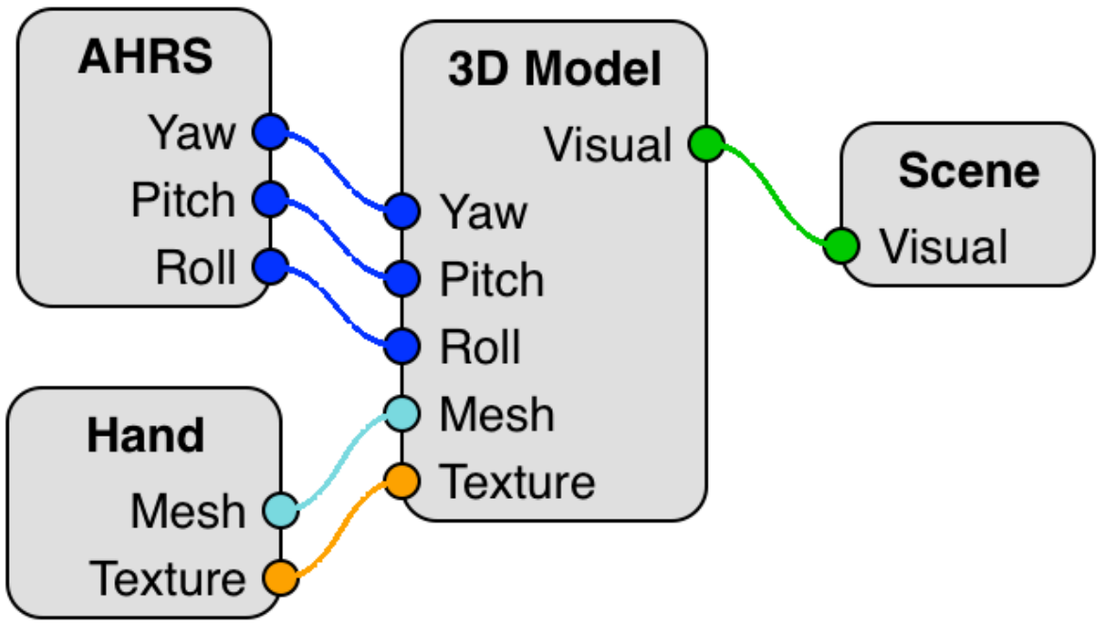

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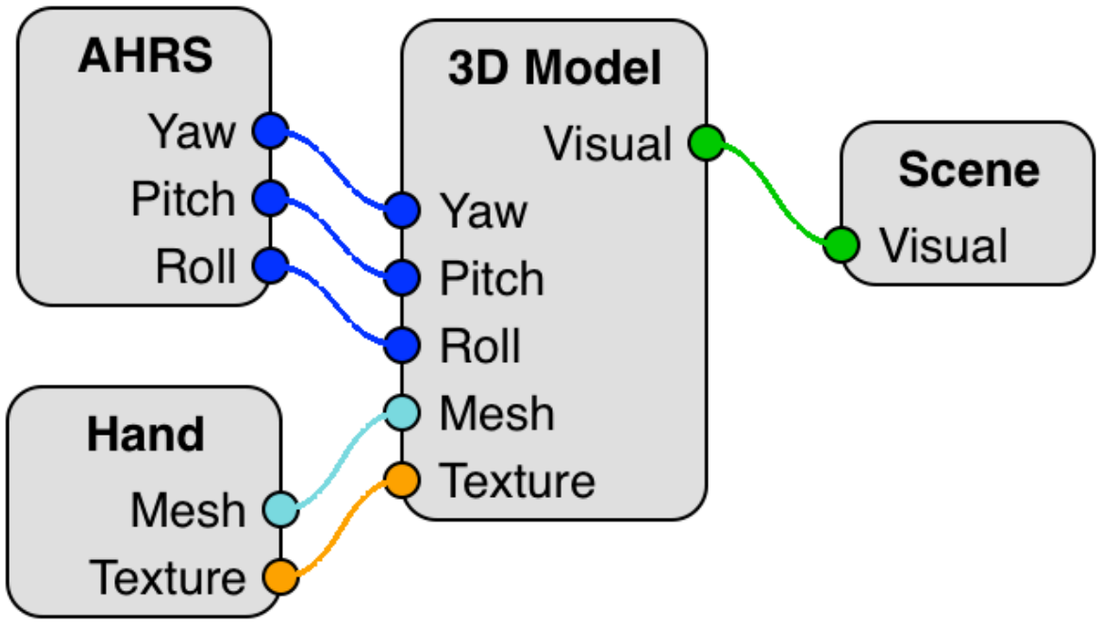

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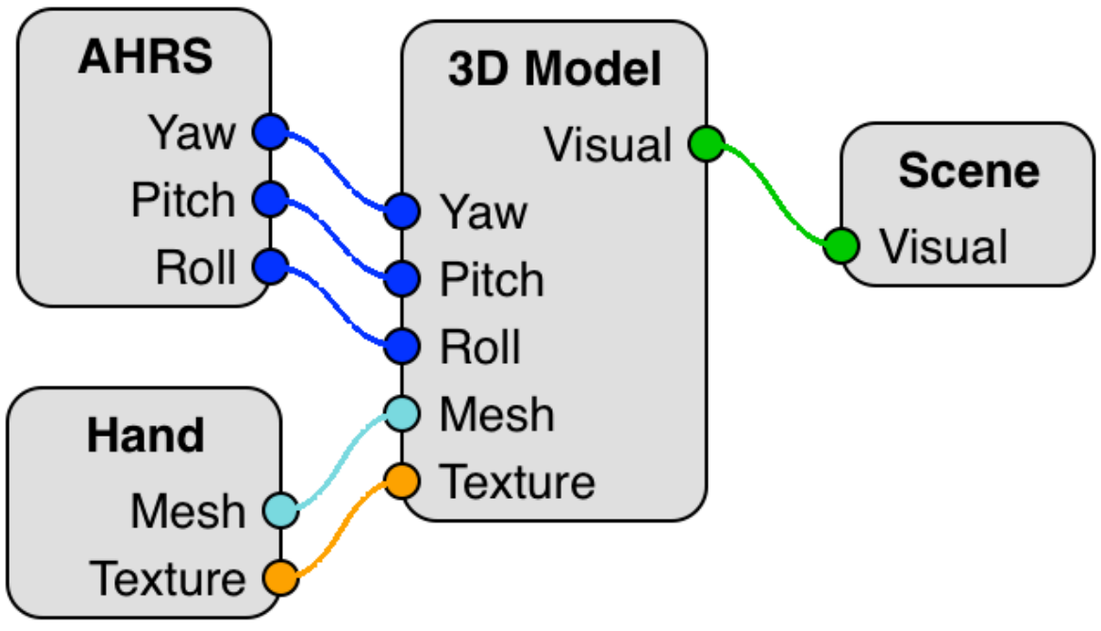

Visualization: Highlight Uncertainties

Chart-based visualization highlights uncertainty of orientation sensor

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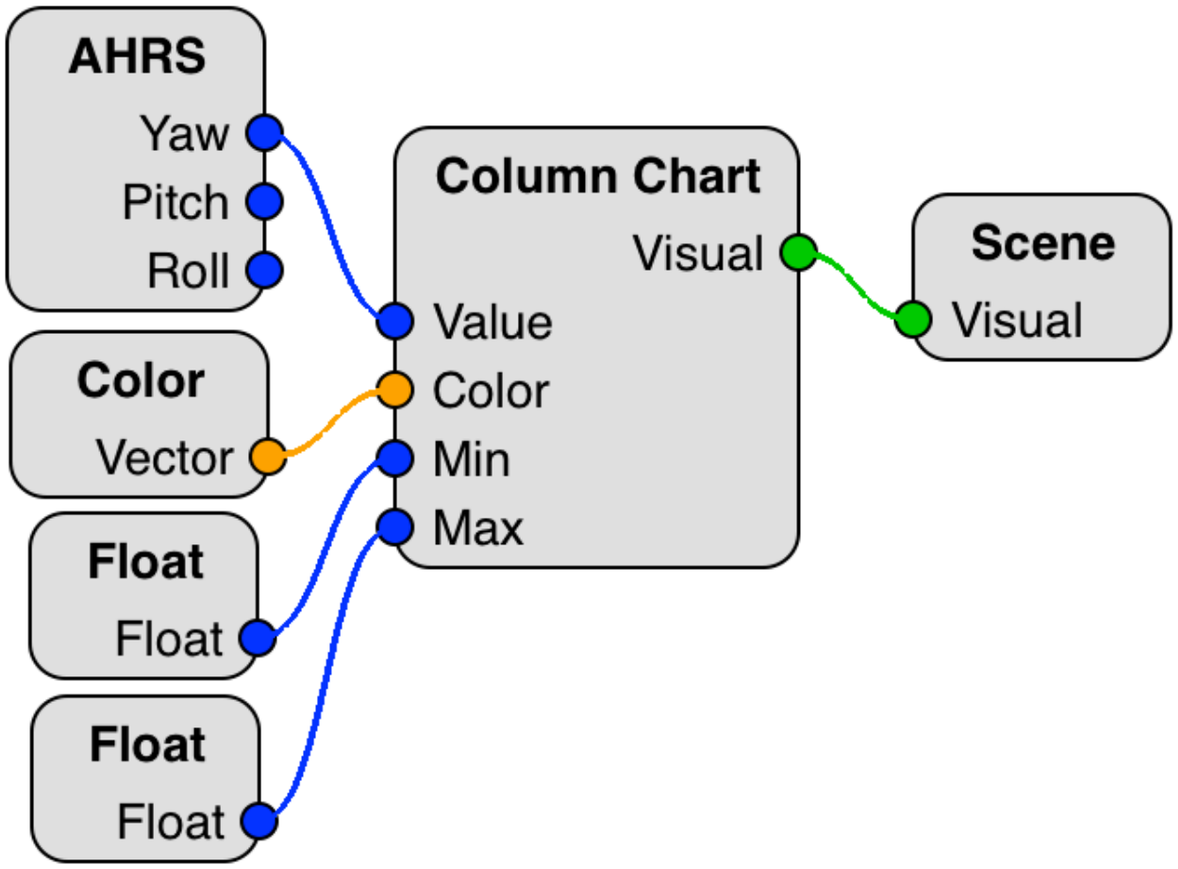

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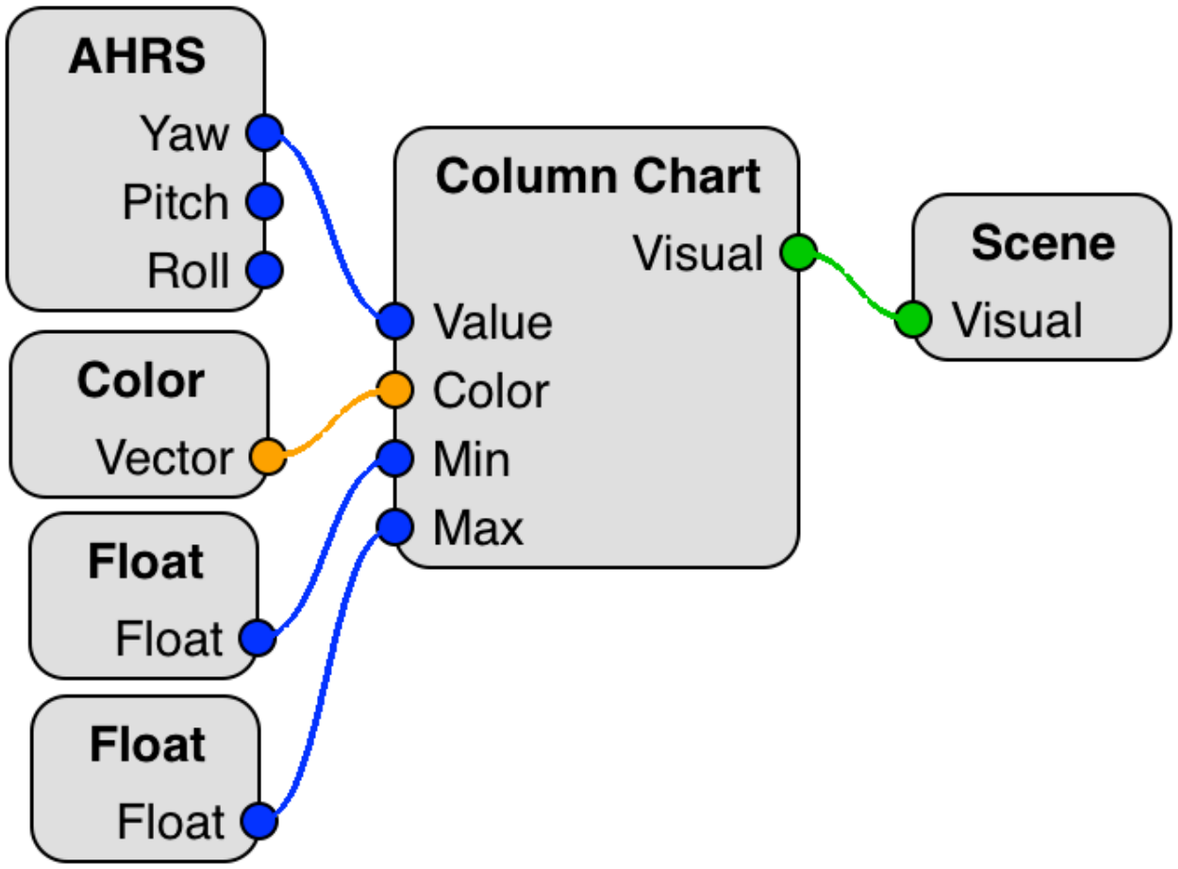

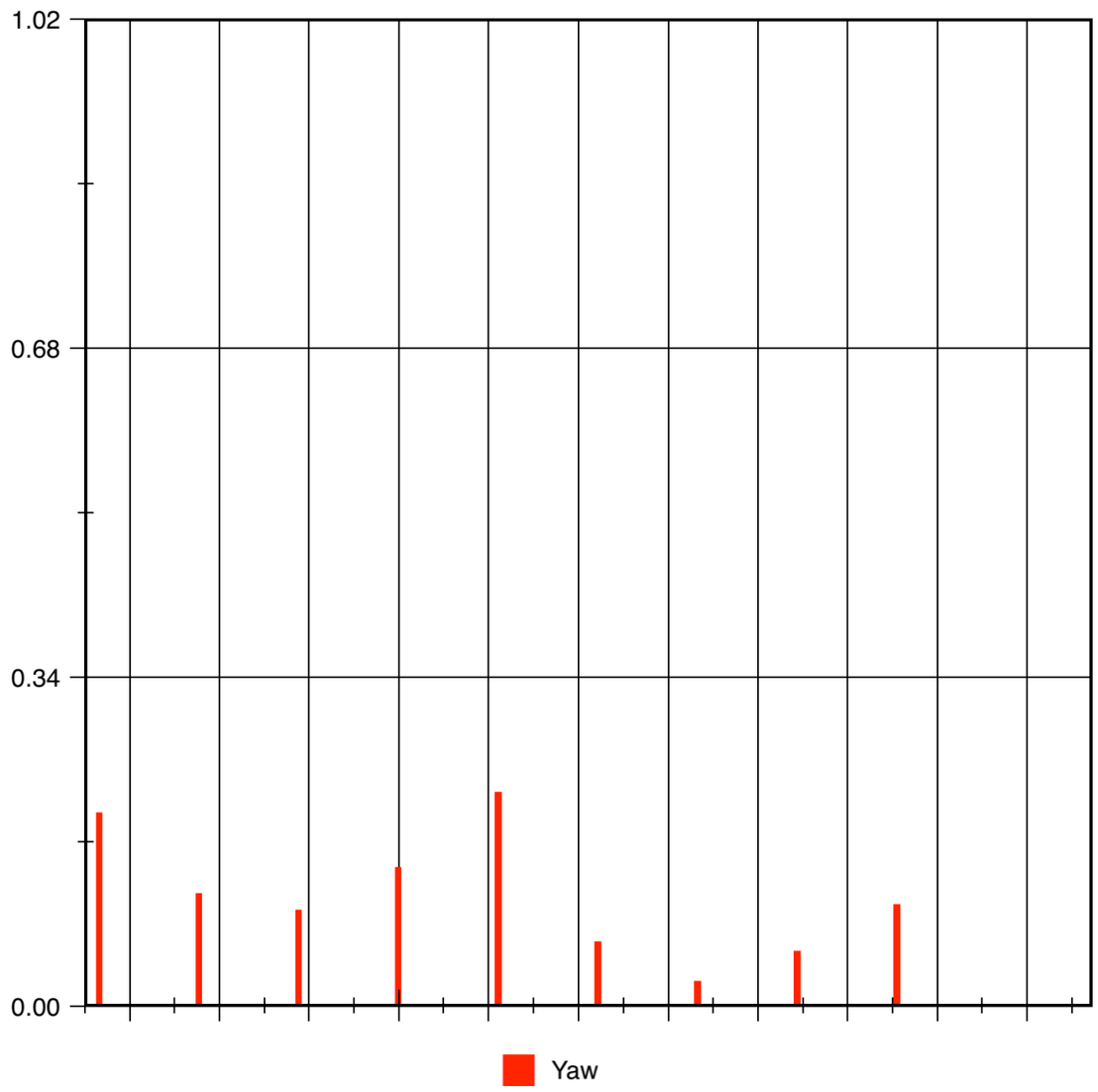

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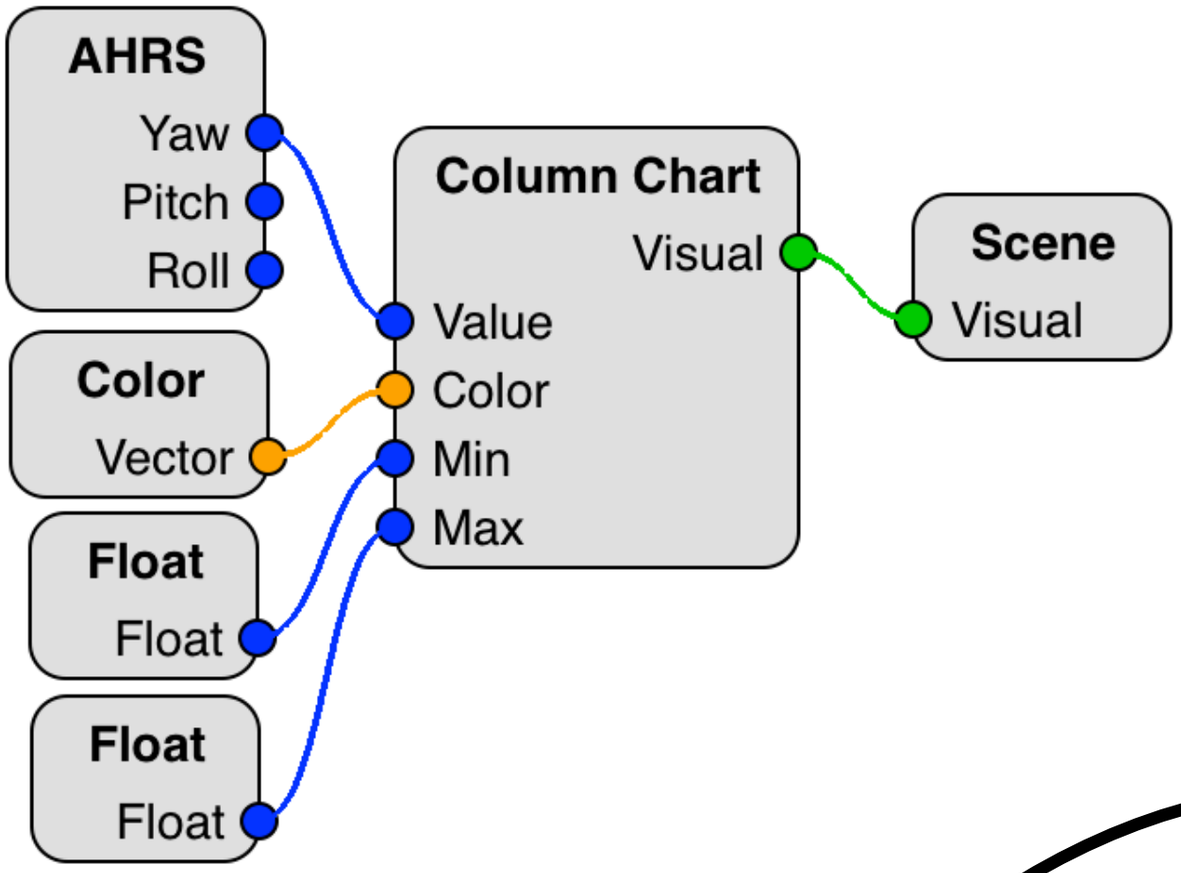
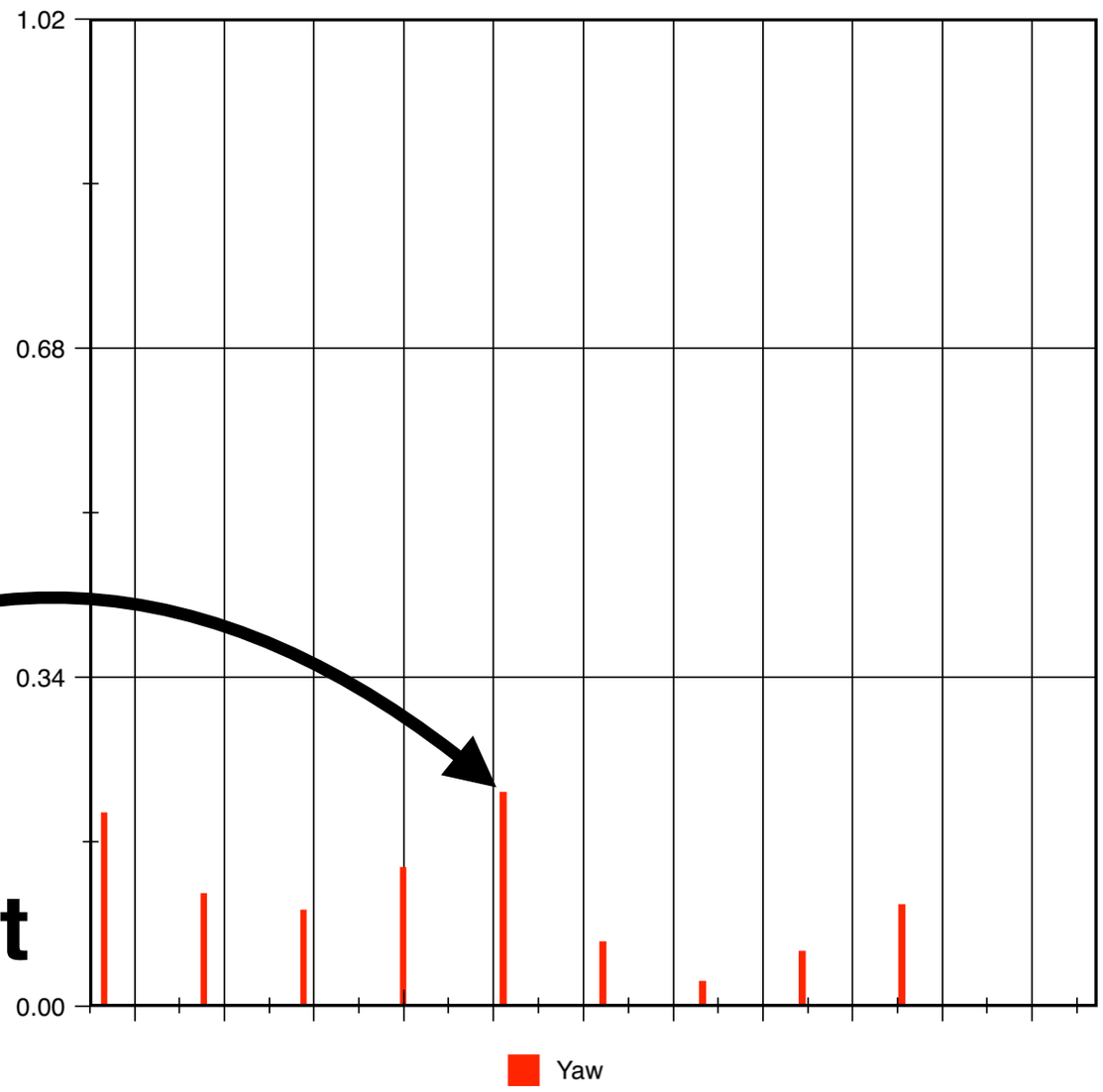
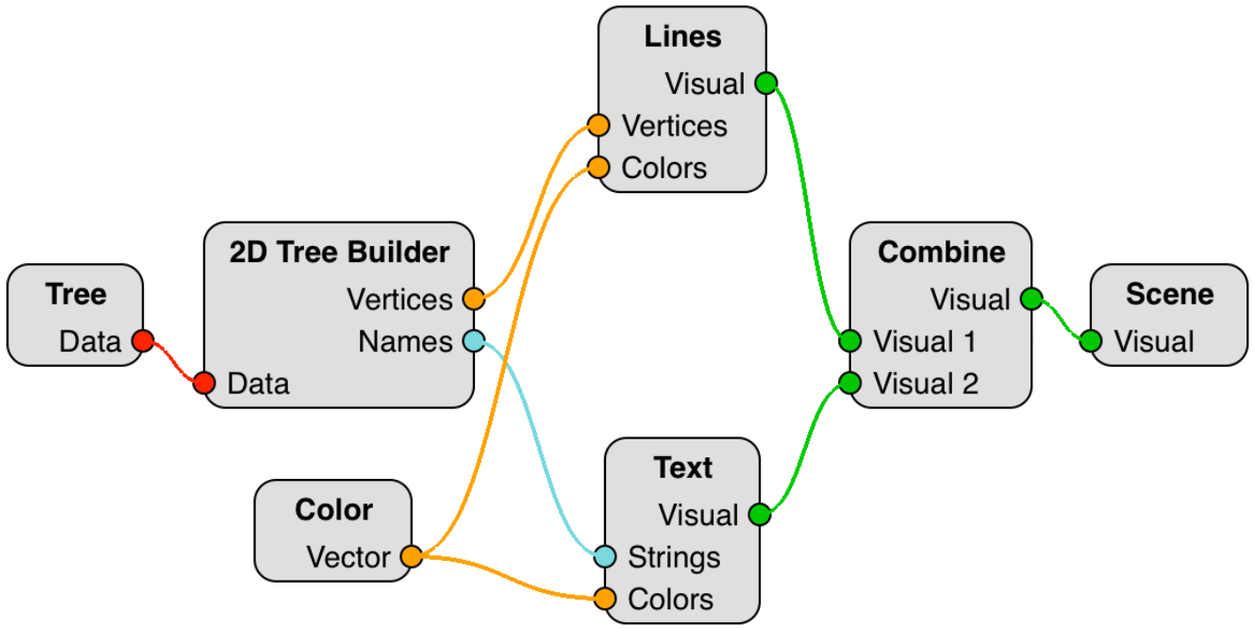




Sensor error visualized can be taken into account to improve the model

Filtering: From Visualization To Analytics

Software Solver: ClustalW (Genomics)



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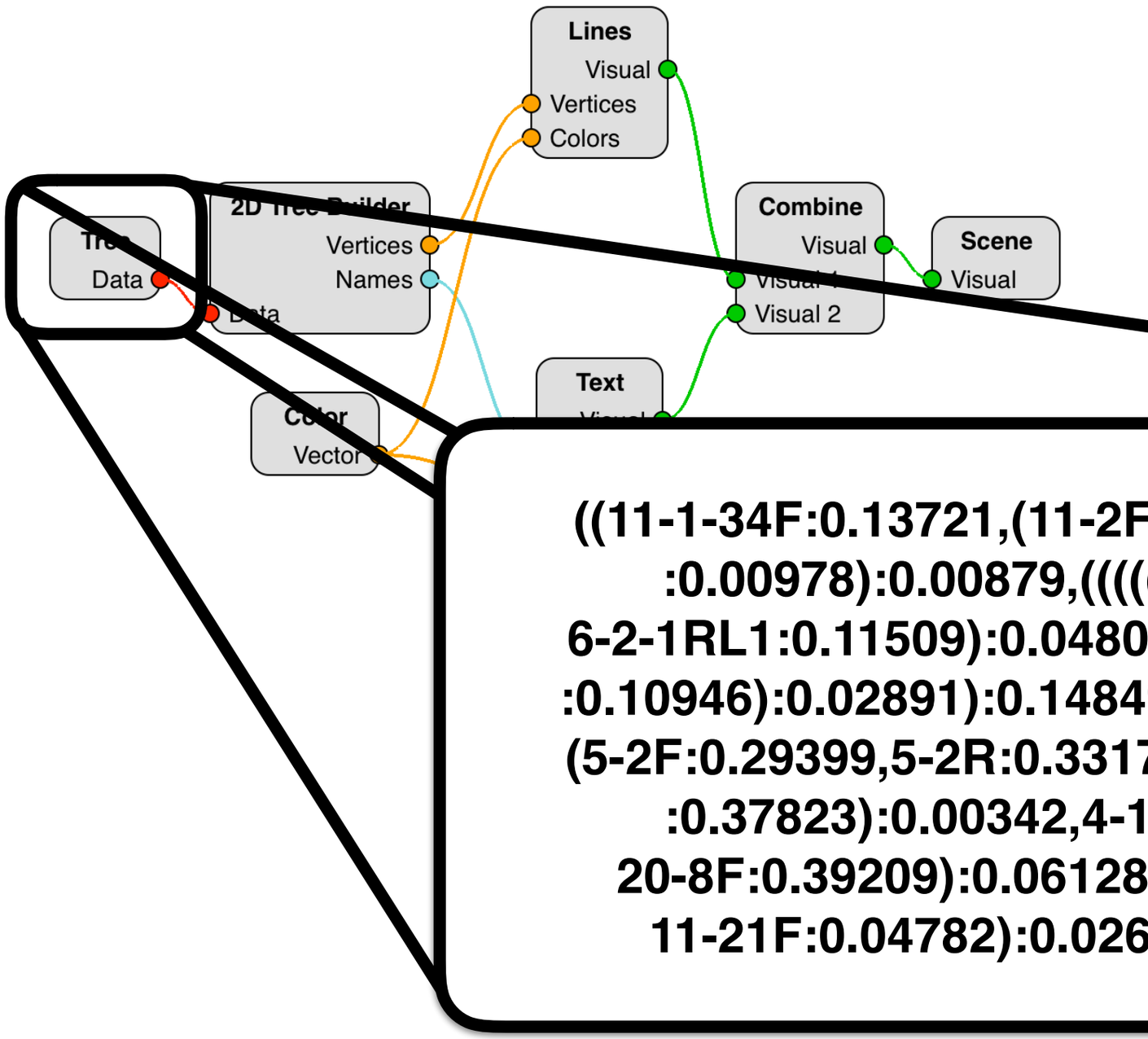

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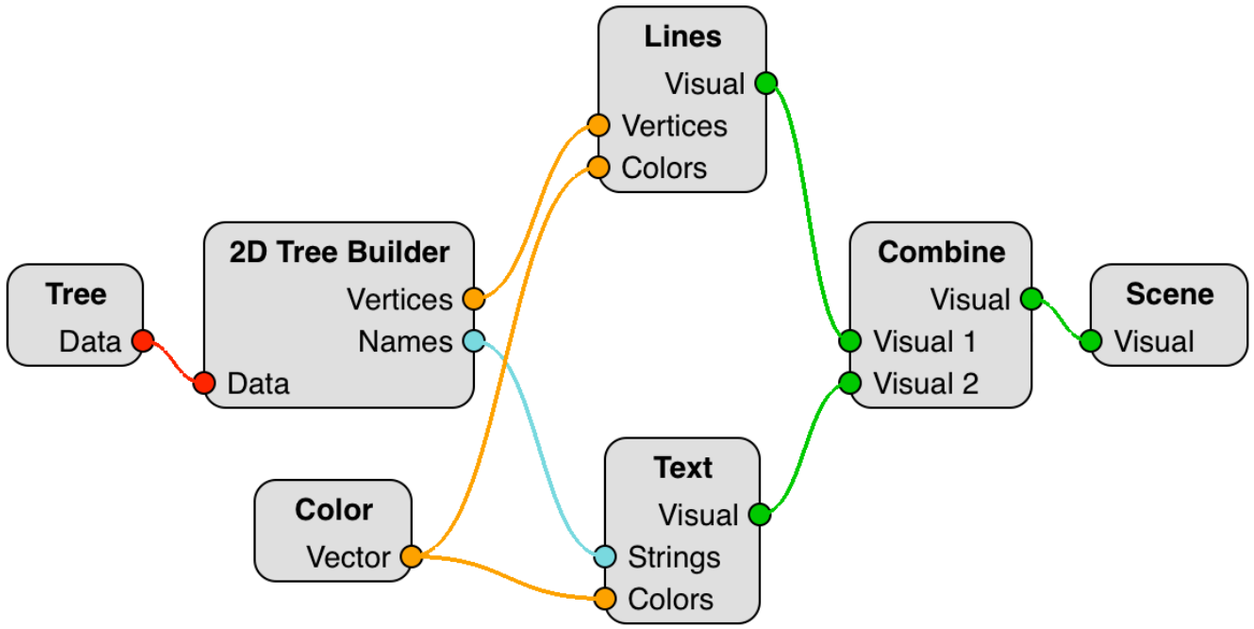

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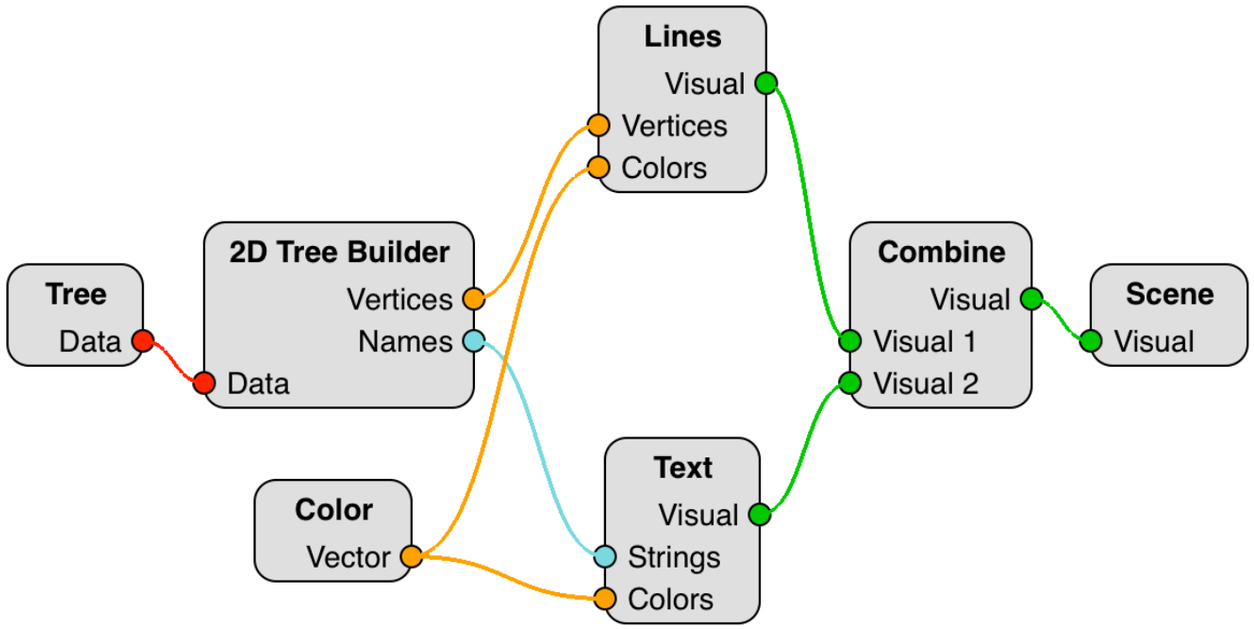

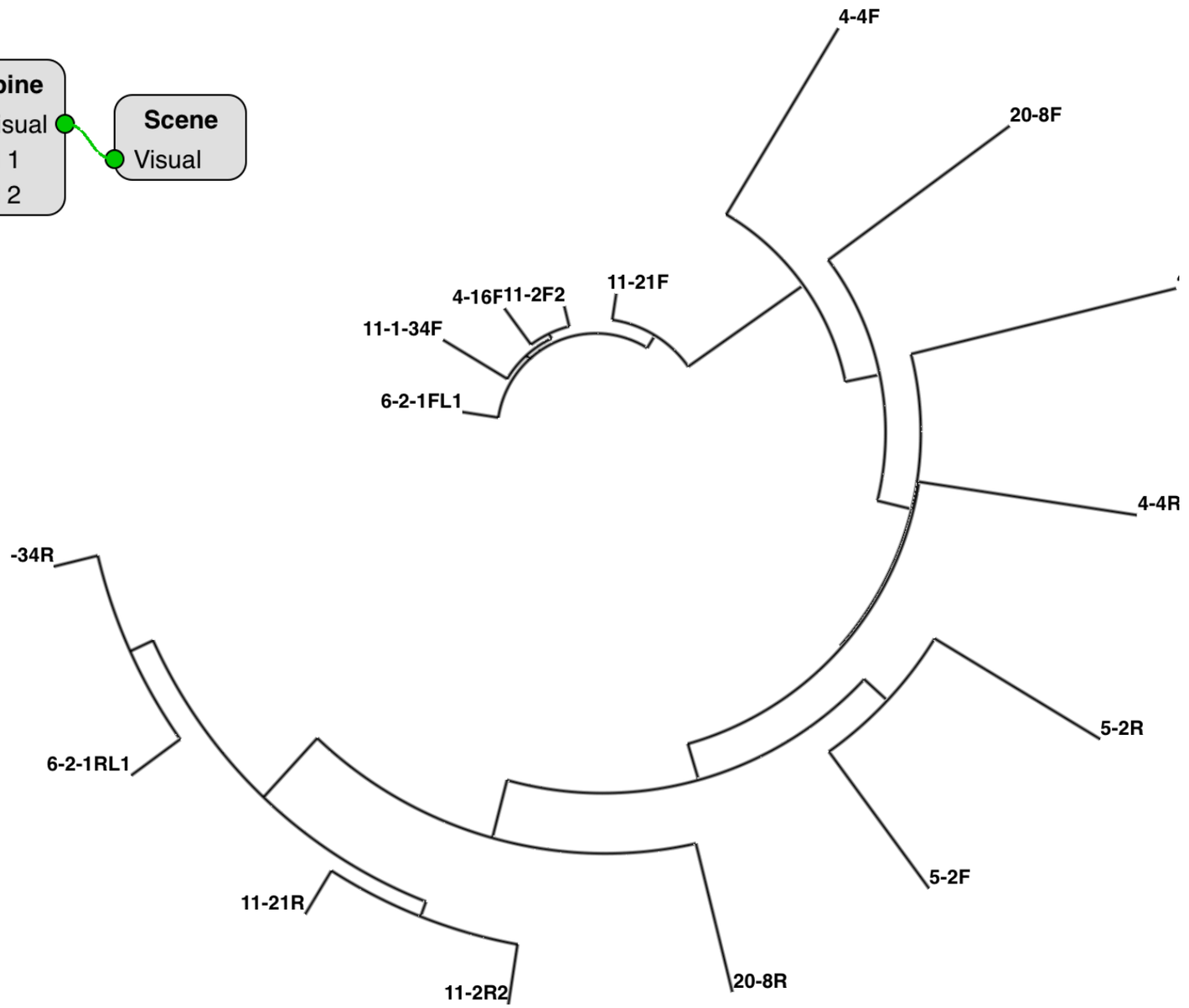

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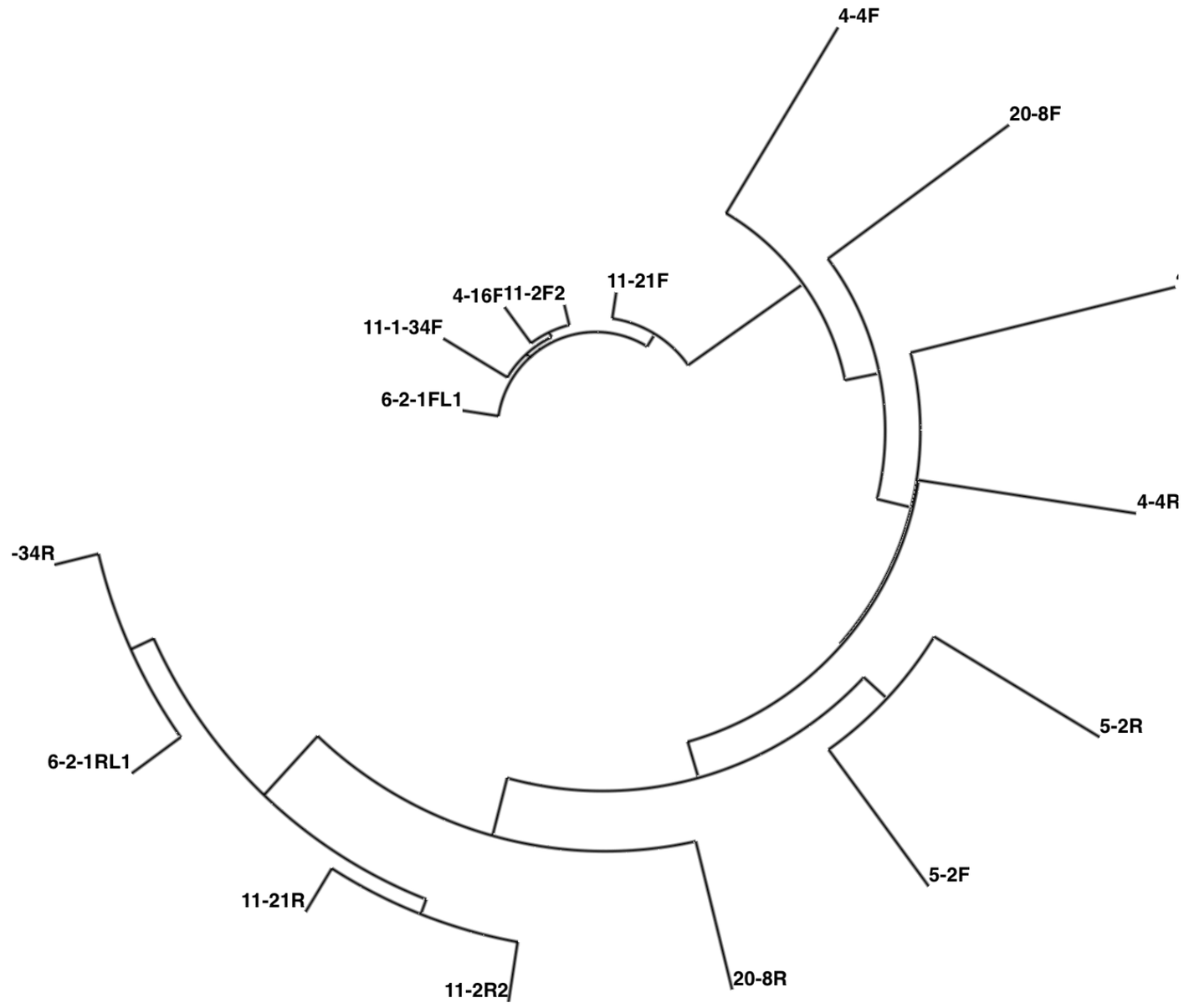

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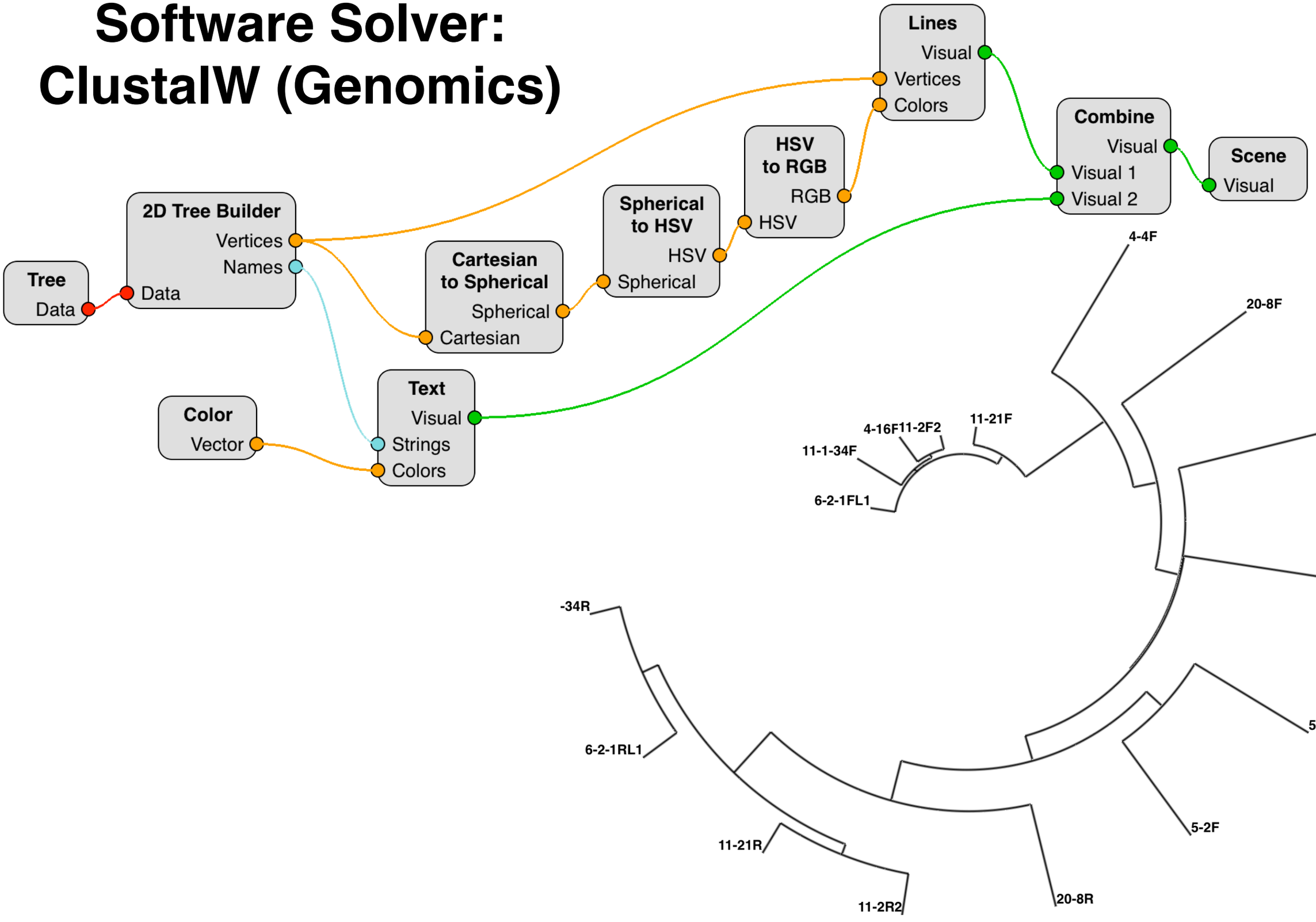

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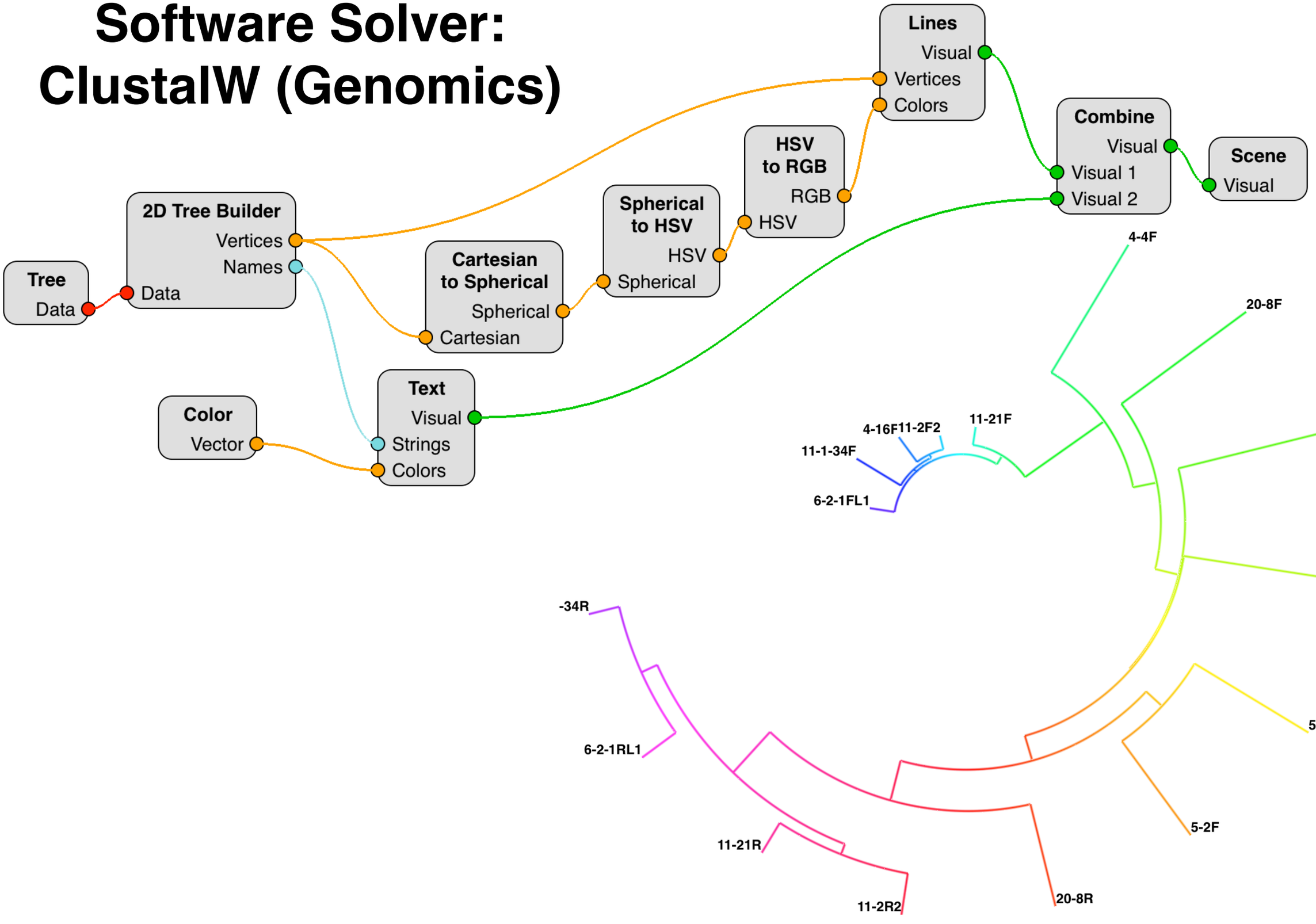

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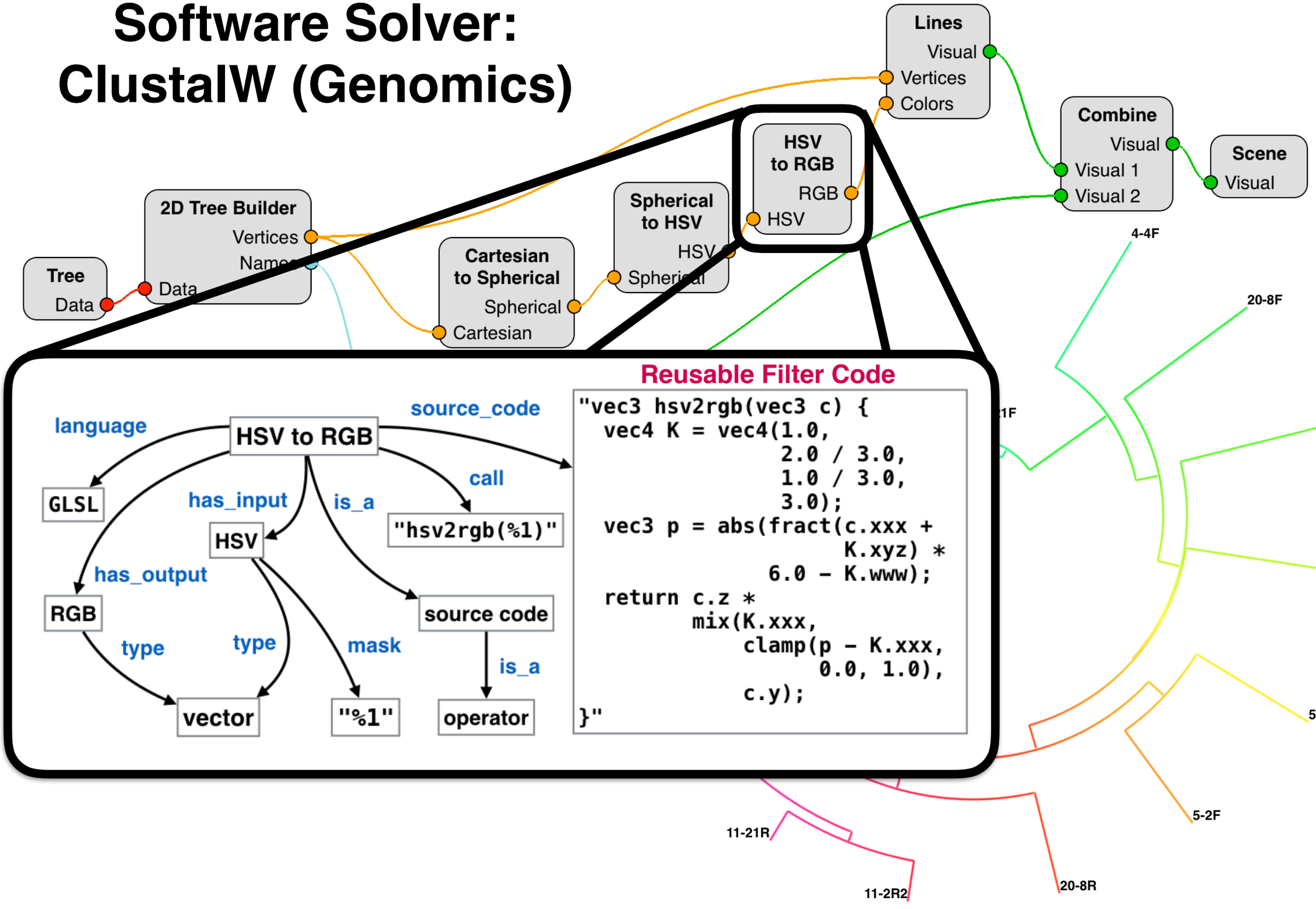

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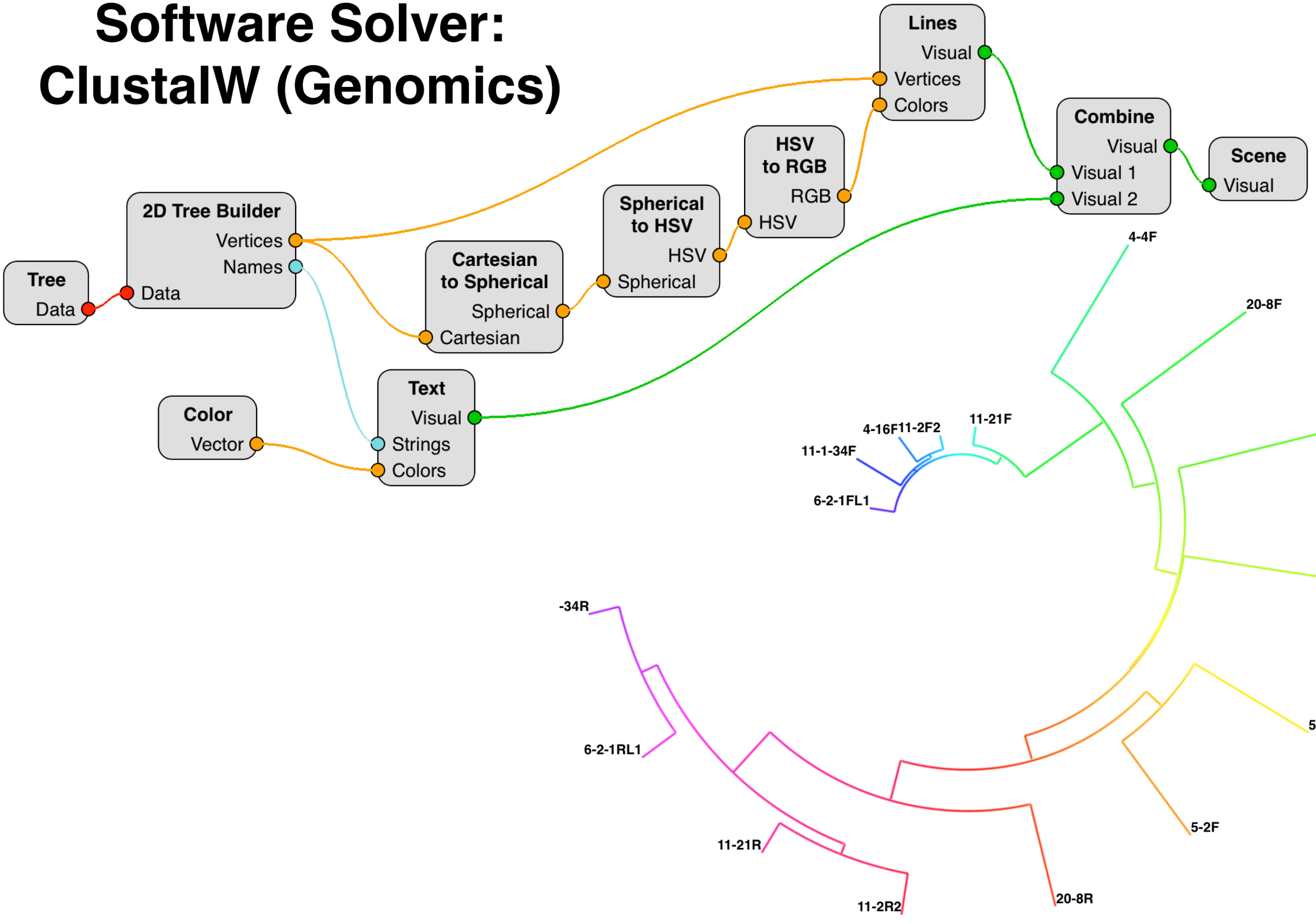

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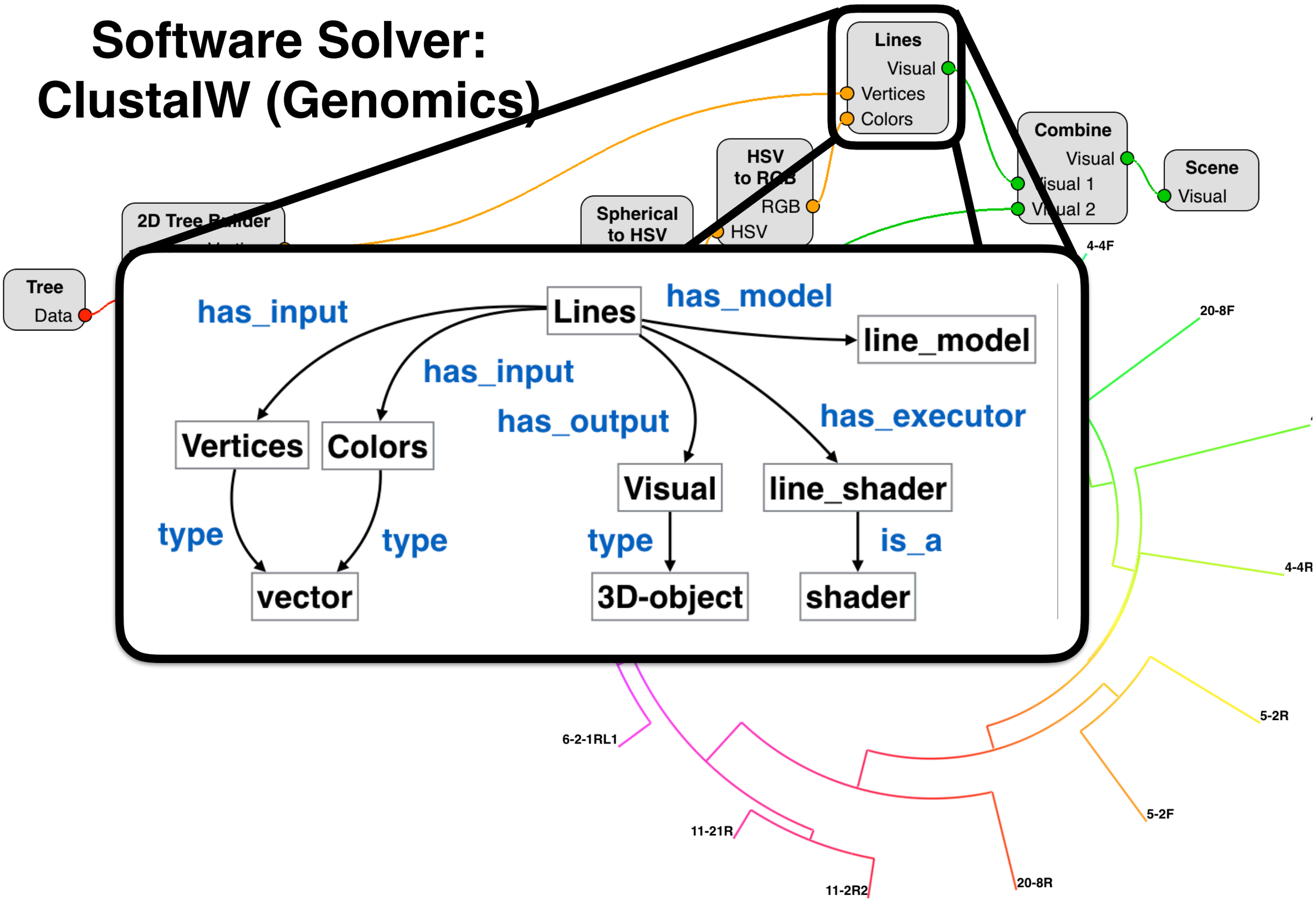
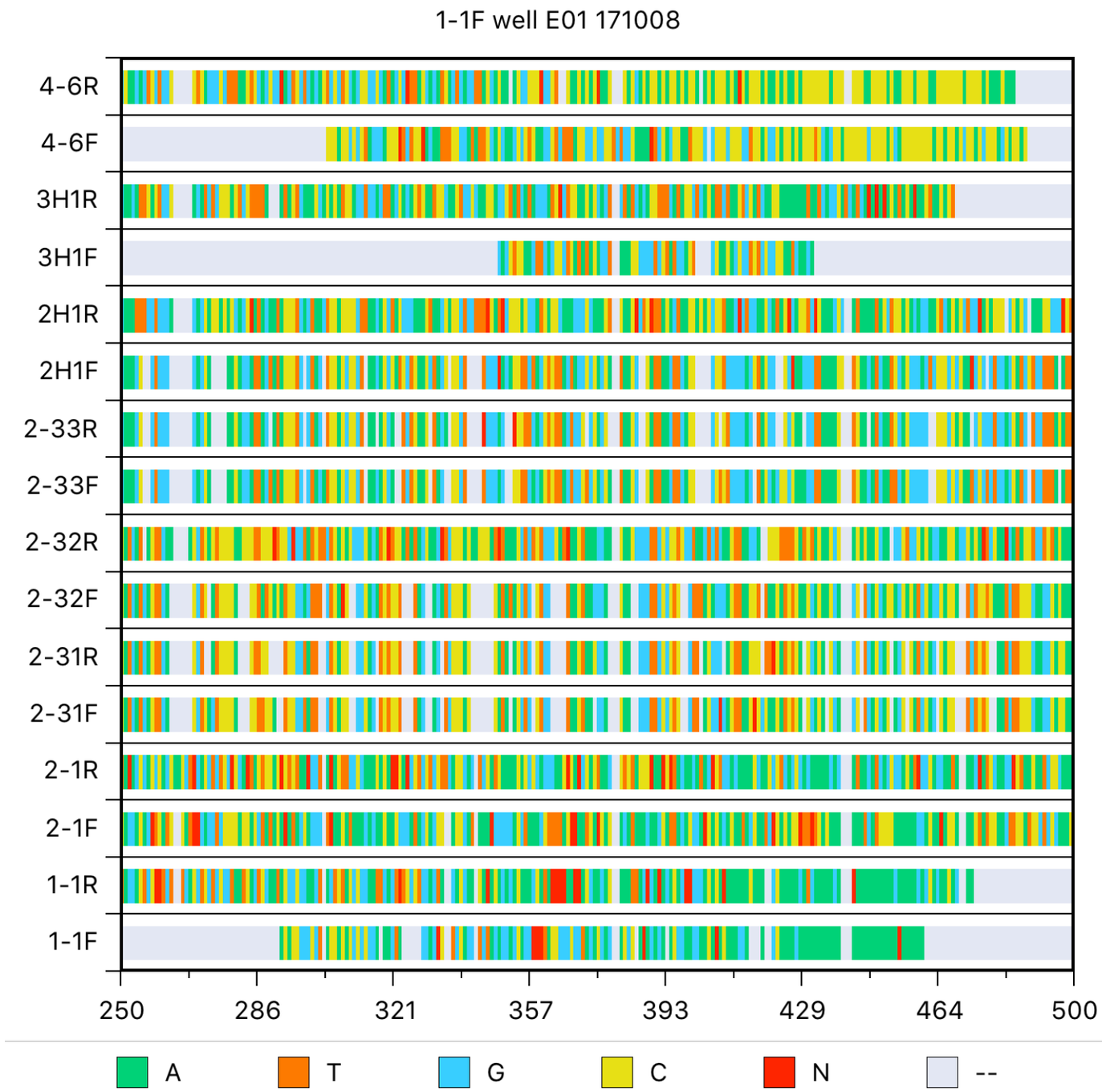


Hardware Solver:
DNA Sequencer (Genomics)



Filtering: Validate Models

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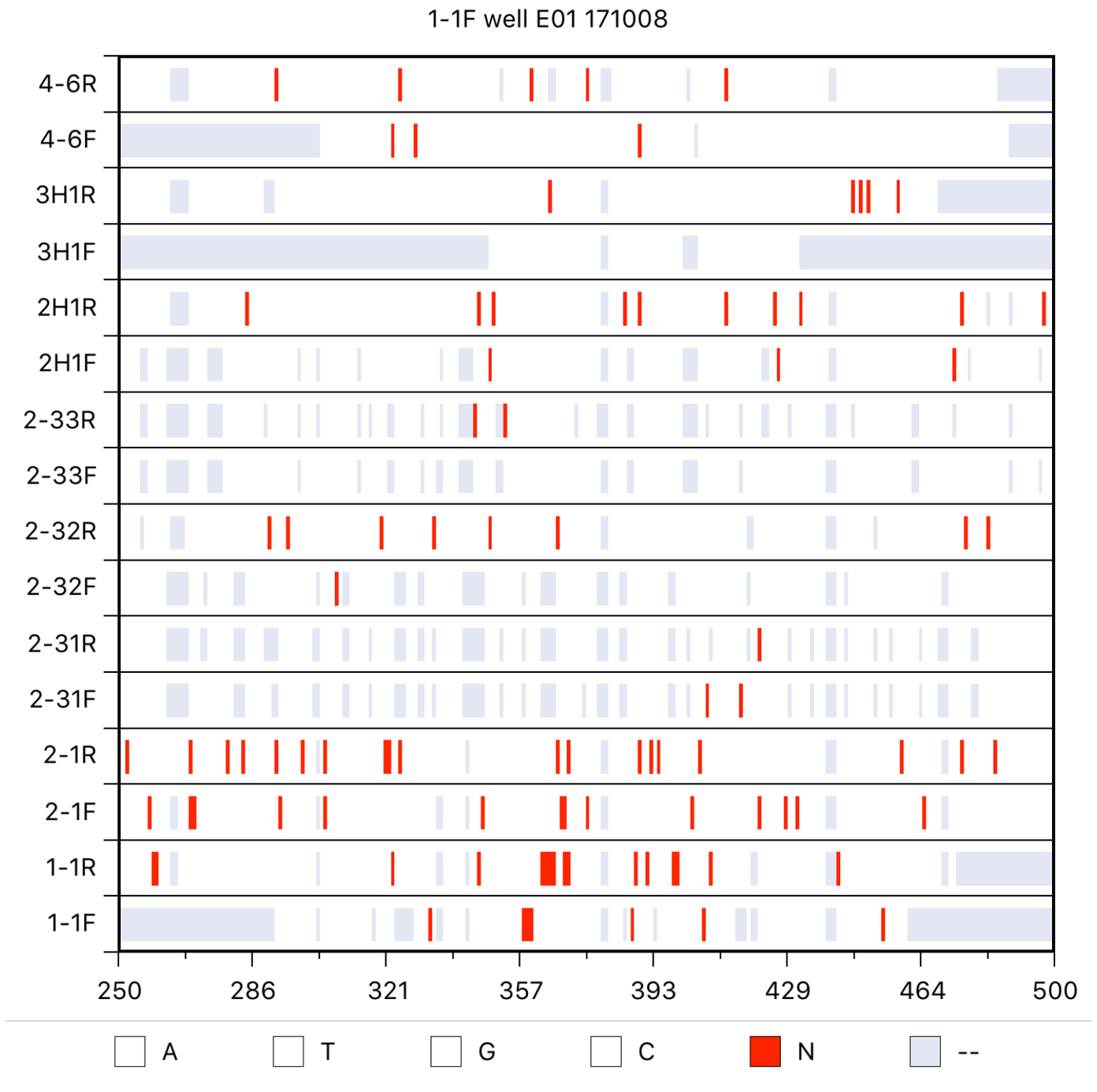

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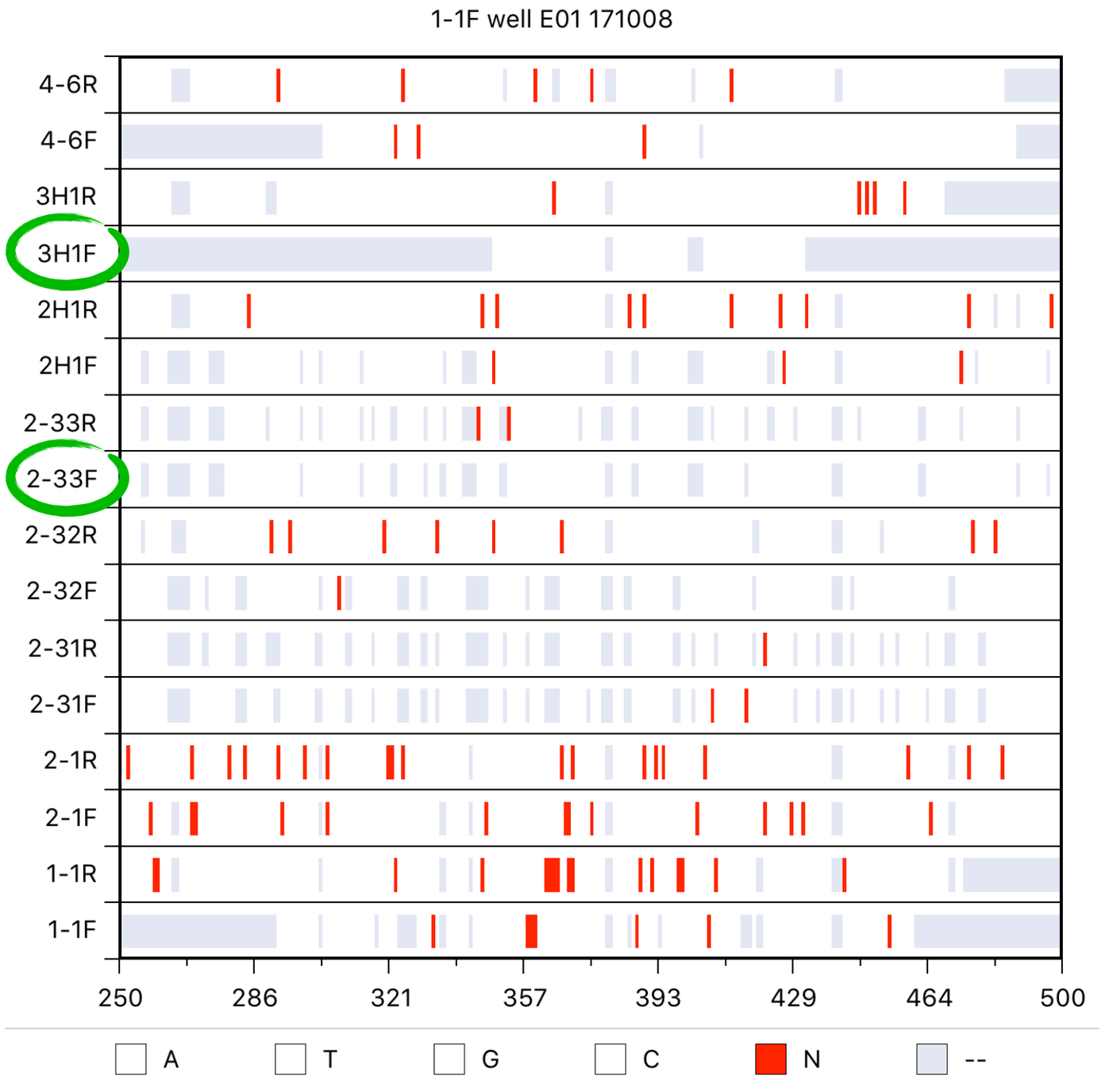

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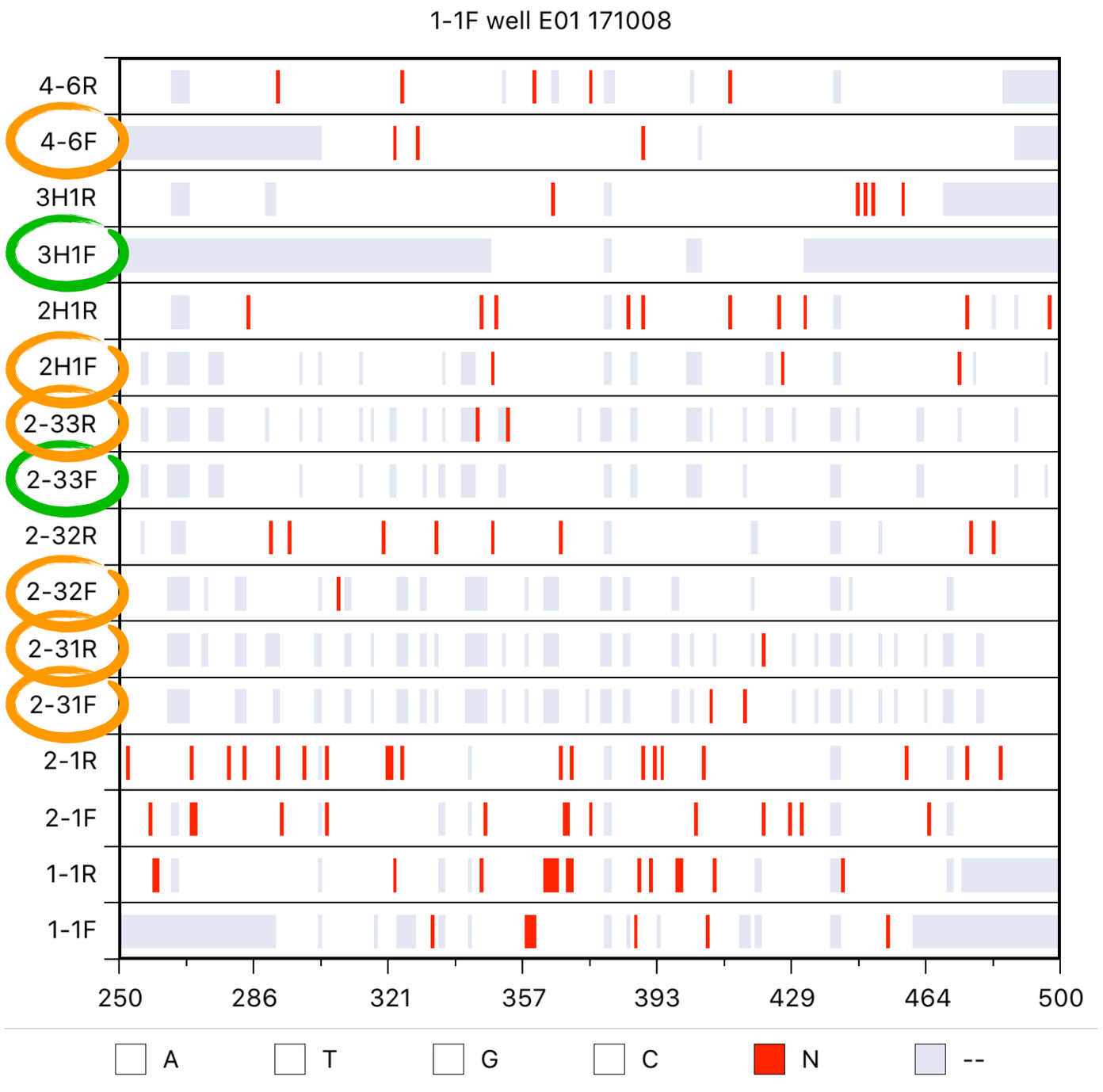

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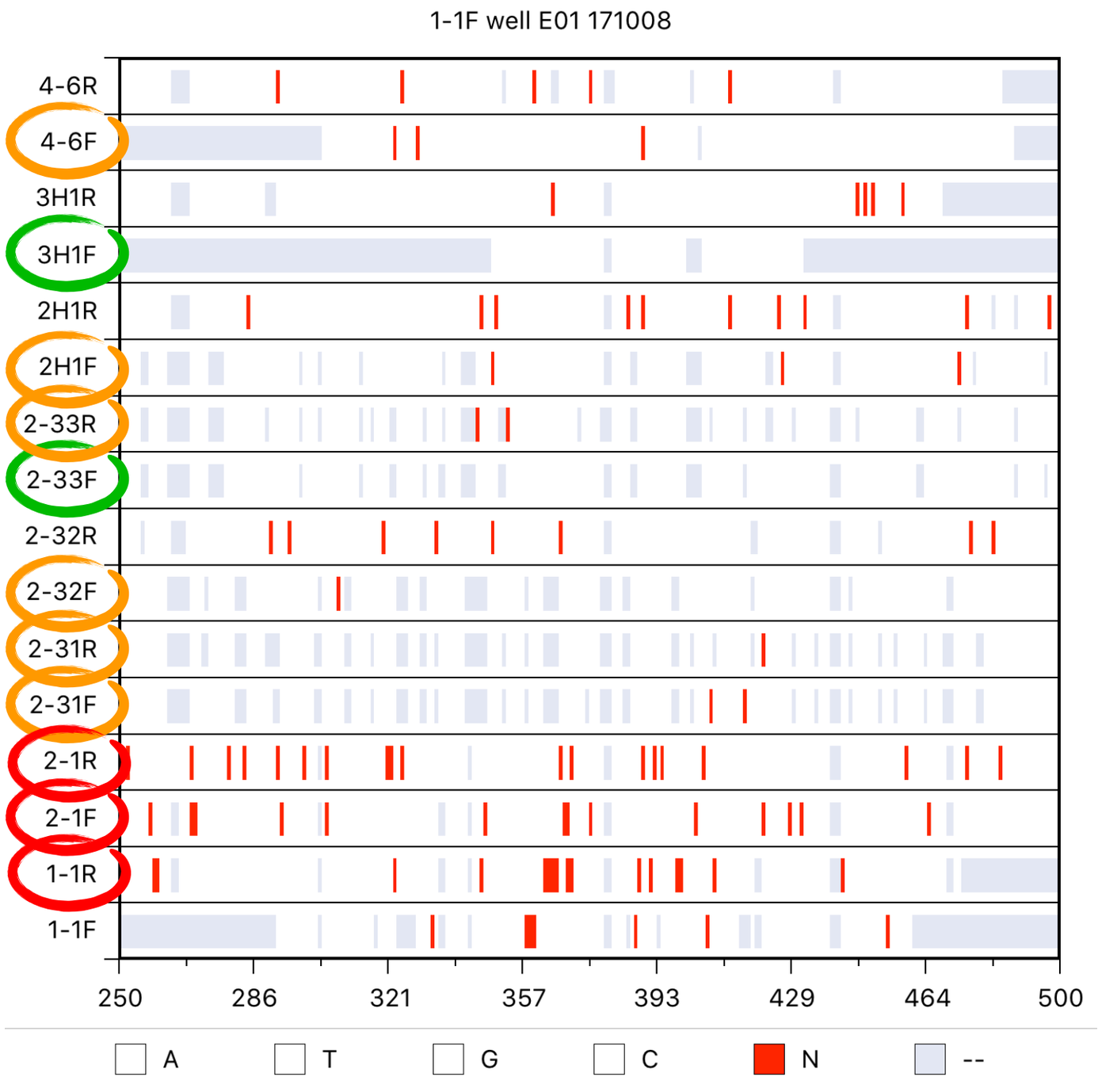

Conclusion

Visual analytics in SciVi is supported by

1. **Ability to adapt to external data sources (including software and hardware solvers)**
2. **Extensible set of graphical capabilities**
3. **Extensible and reusable set of filters**

Next step – tackle Big Data problems:

1. ***Velocity*: SciVi server can be HPC**
2. ***Variety*: SciVi can be adapted to arbitrary data format**
3. ***Volume*: SciVi filtering capabilities can help to reduce data size by aggregation, clamping, splitting, etc.**

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Thank You For Attention!

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Zürich – 2017