Advanced Animation Programming

GPR-450
Daniel S. Buckstein

Animation Blending: Blend Trees
Weeks 9 – 11

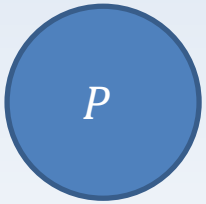
License

Animation Blending

- Blend trees
  - …and slightly more advanced blending operations
- Future topic/application:
  - Player/character control

Animation Blending: Blend Trees

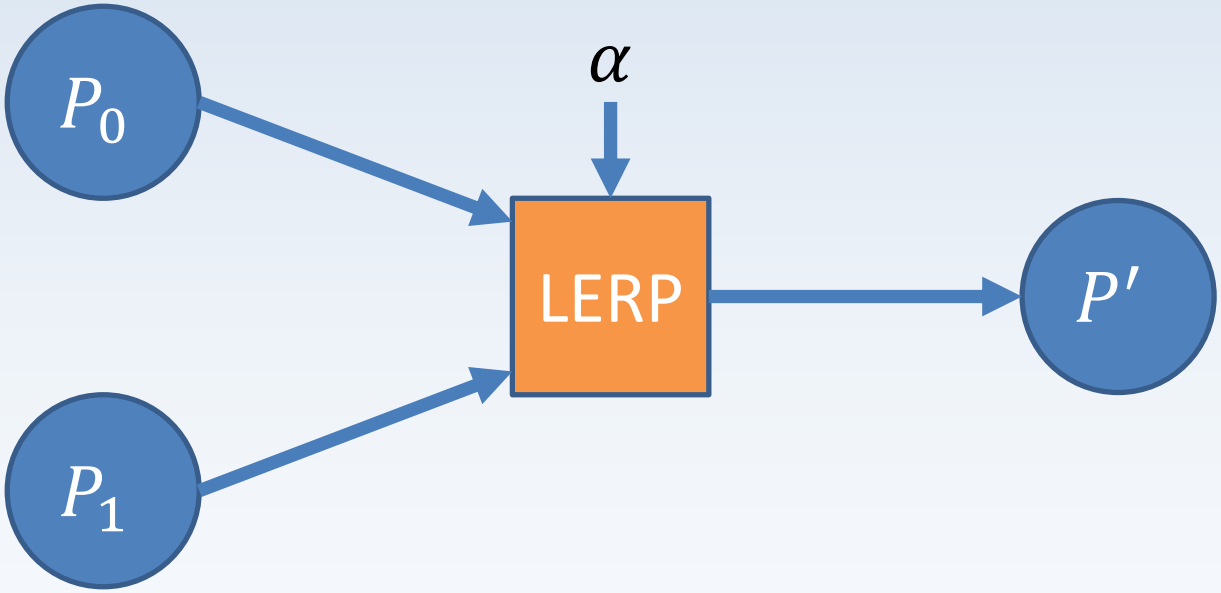
- Up until this point we have been doing *math*.
- ***Full-circle***: now think of a ***pose*** as some sort of tangible, visible *point in space*
  - Even though it is not a literal point… yay metaphors ☺



- We shall use spatial reasoning to represent, describe and visualize non-spatial concepts

Animation Blending: Blend Trees

- The operations we describe above can be visualized using ***blend nodes***:



Animation Blending: Blend Trees

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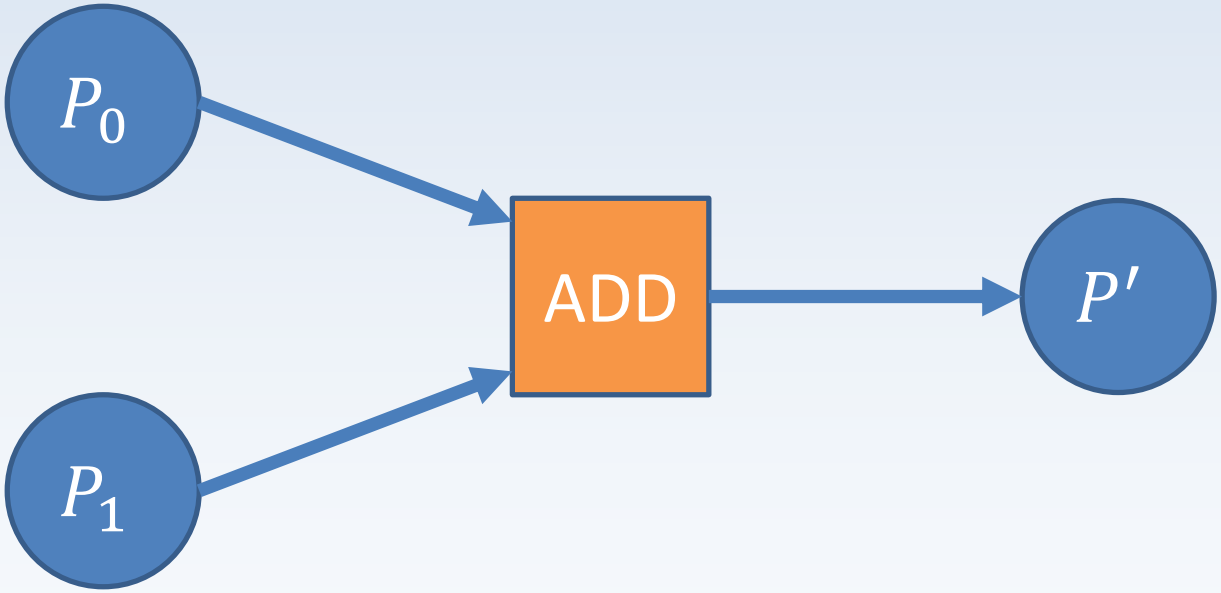
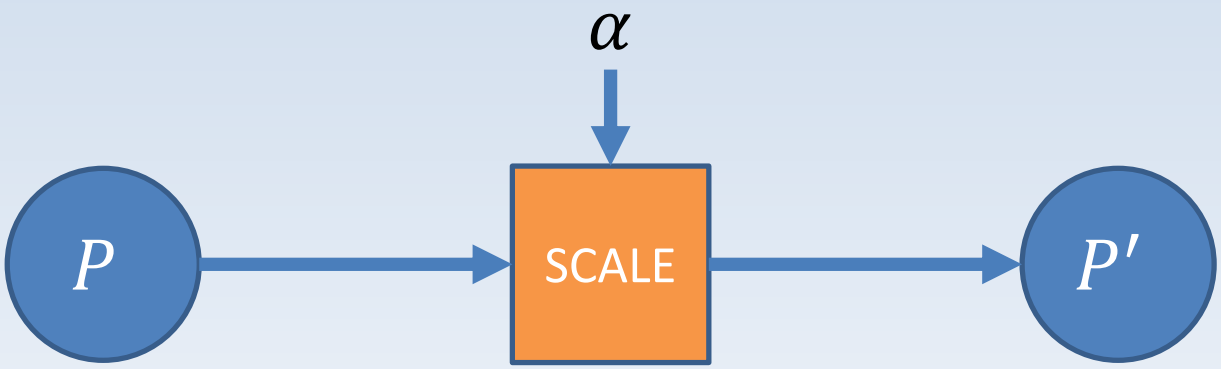
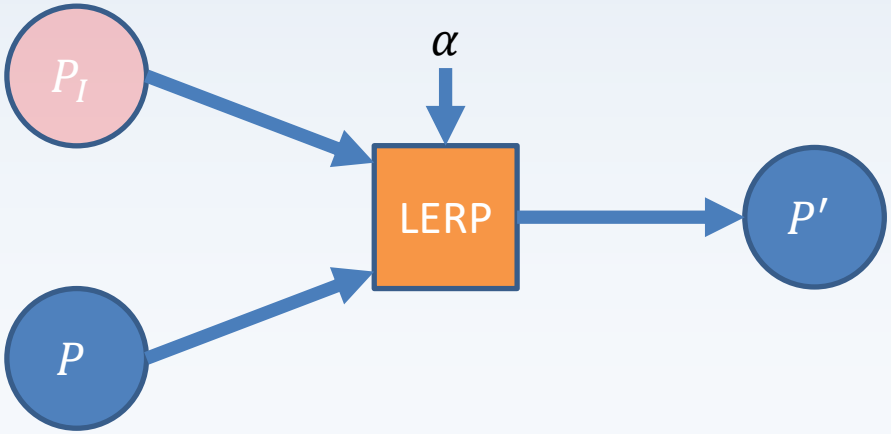


Animation Blending: Blend Trees

- New nodes can be defined in terms of others:

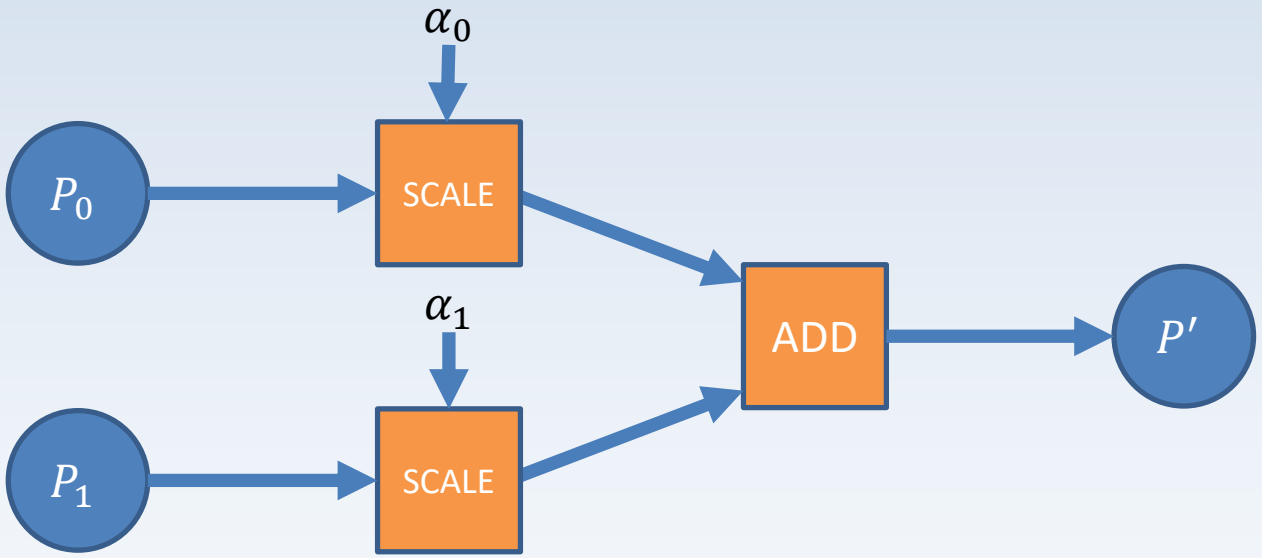


Exactly the same as:



Animation Blending: Blend Trees

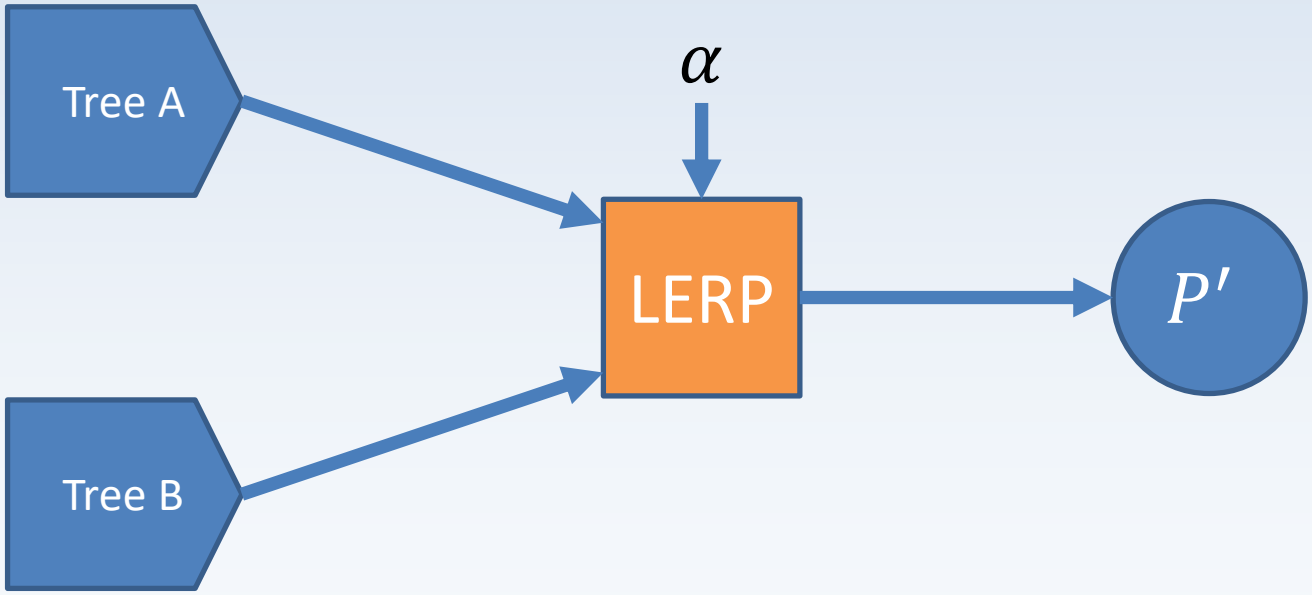
- A sequence of *blend nodes* that feeds results into other nodes is called a ***blend tree***:



- Which operation does this tree perform???

Animation Blending: Blend Trees

- You may also see *entire trees* represented as single nodes, for more complex scenarios:



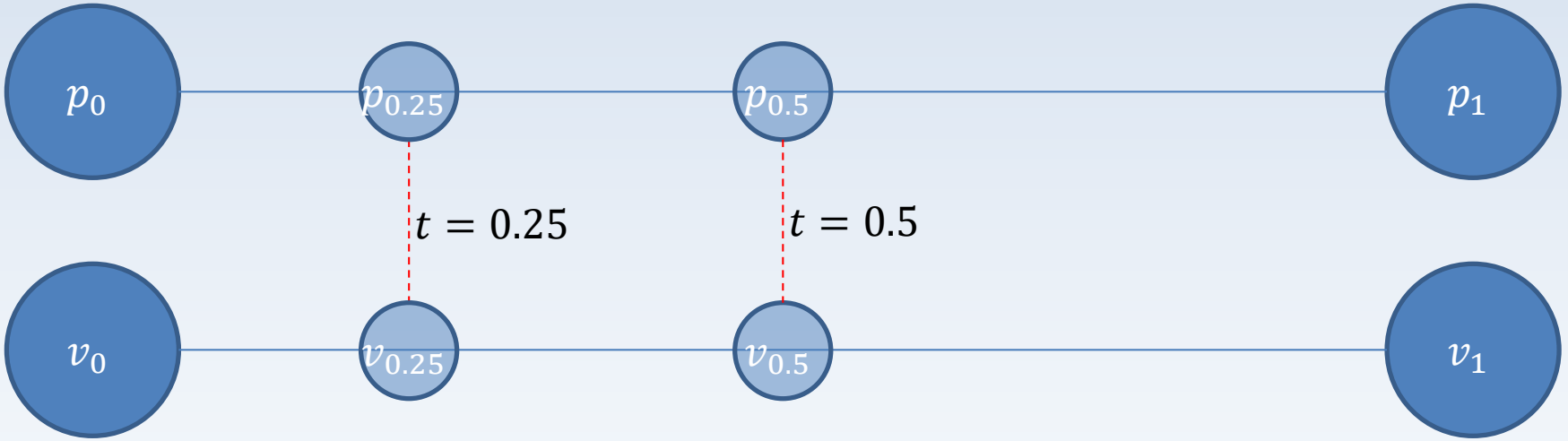
Animation Blending: Blend Trees

- The concept is *exactly the same* for full hierarchies: we know that we are iterating

- How about *pose-to-pose animation*???
- Welcome to ***clips***

Animation Blending: Blend Trees

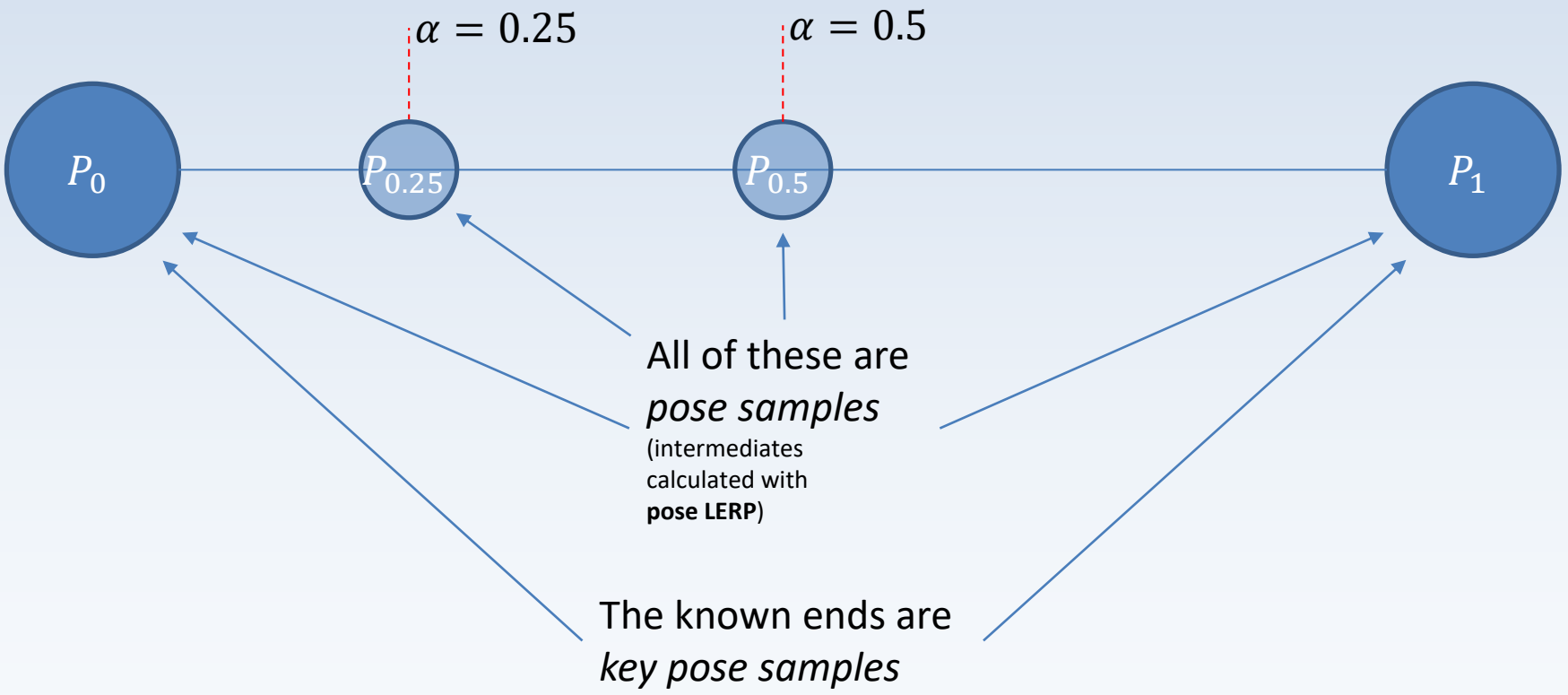
- What happens when we interpolate between two points in space? How about vectors?



…we get another point/vector!

Animation Blending: Blend Trees

- Let's use the same diagram to represent poses



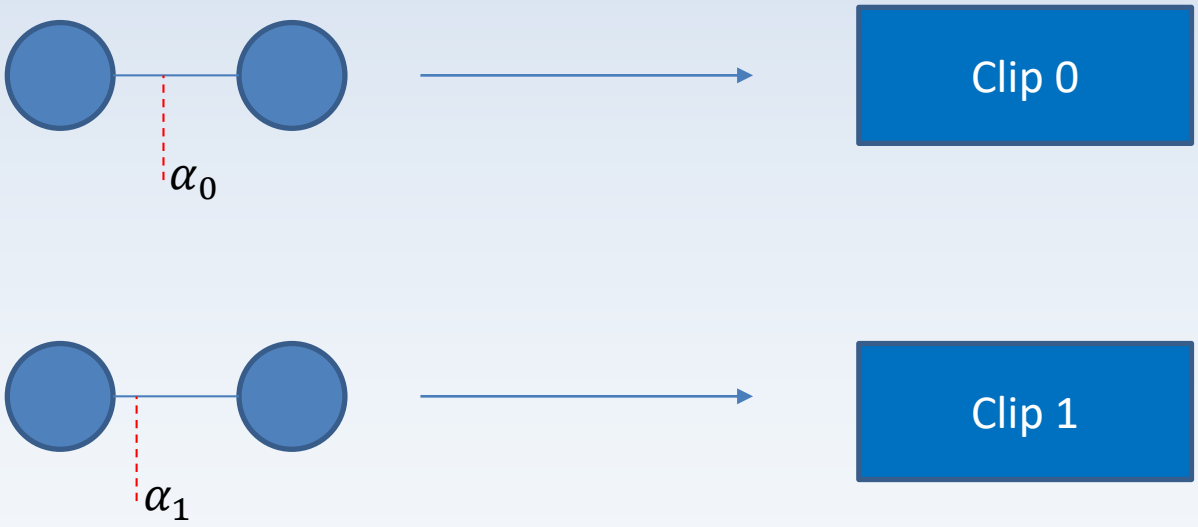
Animation Blending: Blend Trees

- A sequence of pose samples is called a ***clip***

- Clips have blend nodes too:

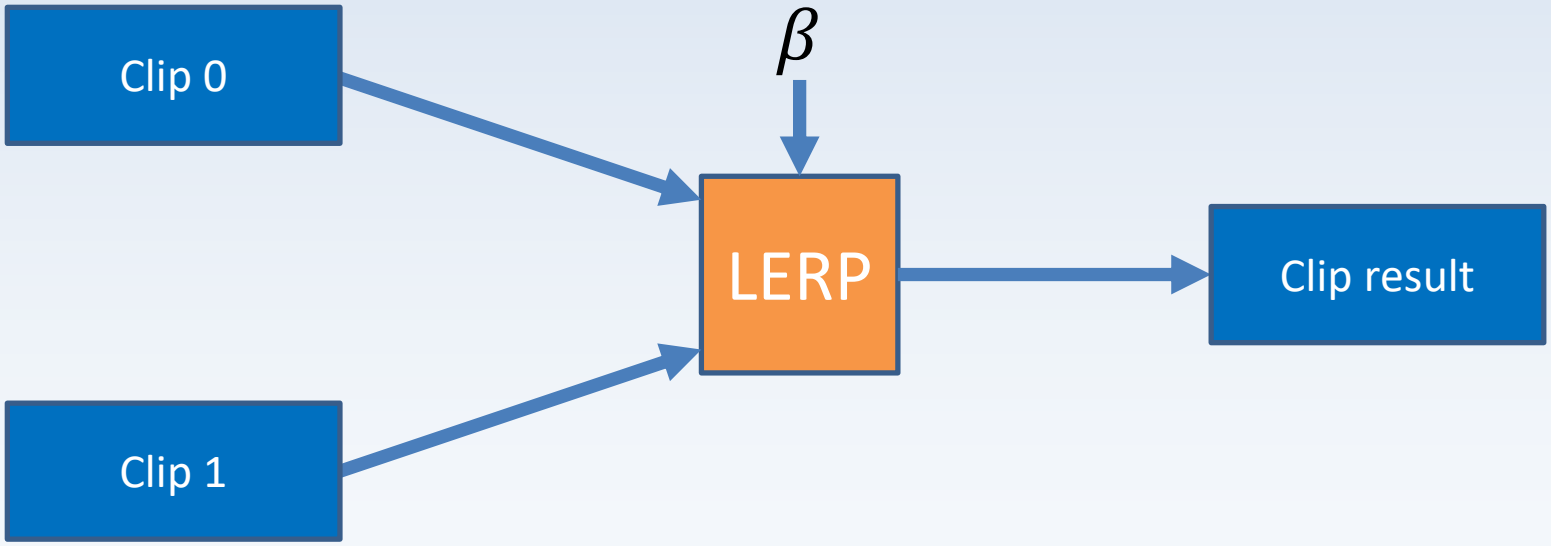
Animation Blending: Blend Trees

- Clips are nodes because they yield the results of other operations (pose lerp):



Animation Blending: Blend Trees

- Typically use *beta* to describe *clip blend* parameter, while *alpha* is the *pose blend* parameter:

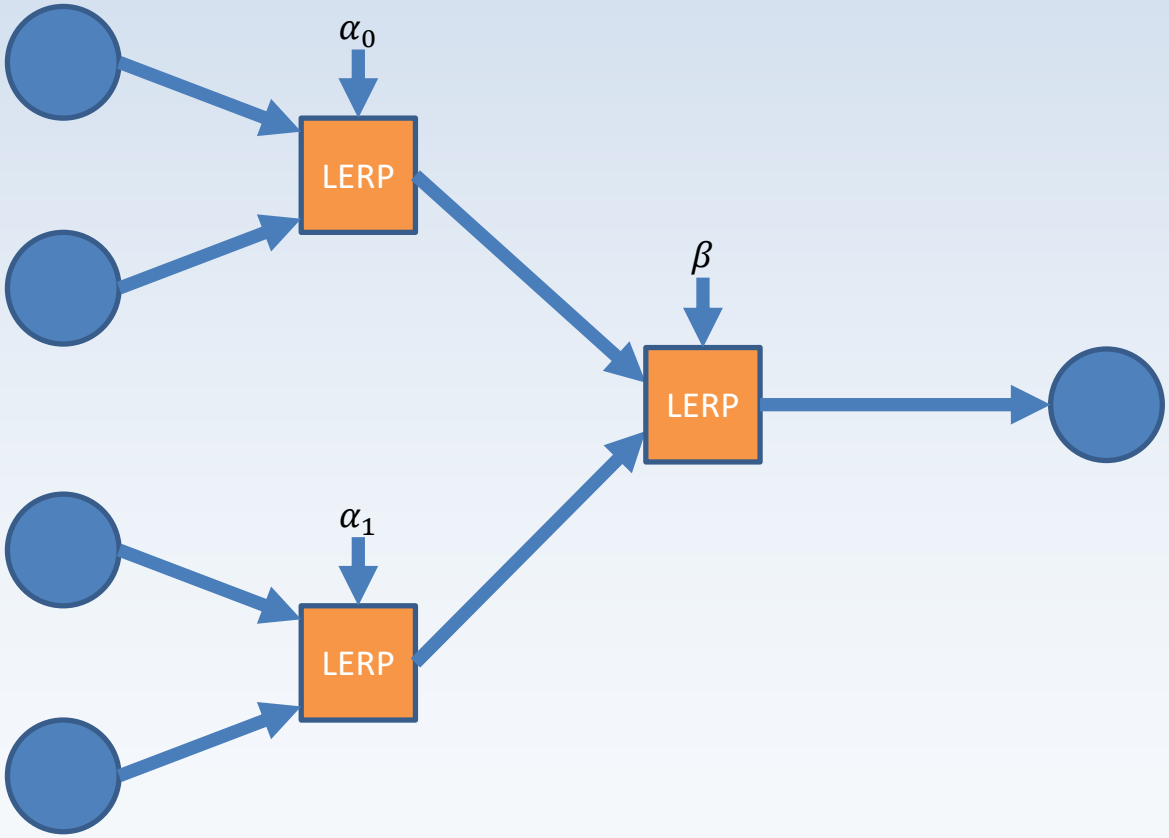


Animation Blending: Blend Trees

- *Clip blending* has the same effect as this tree:

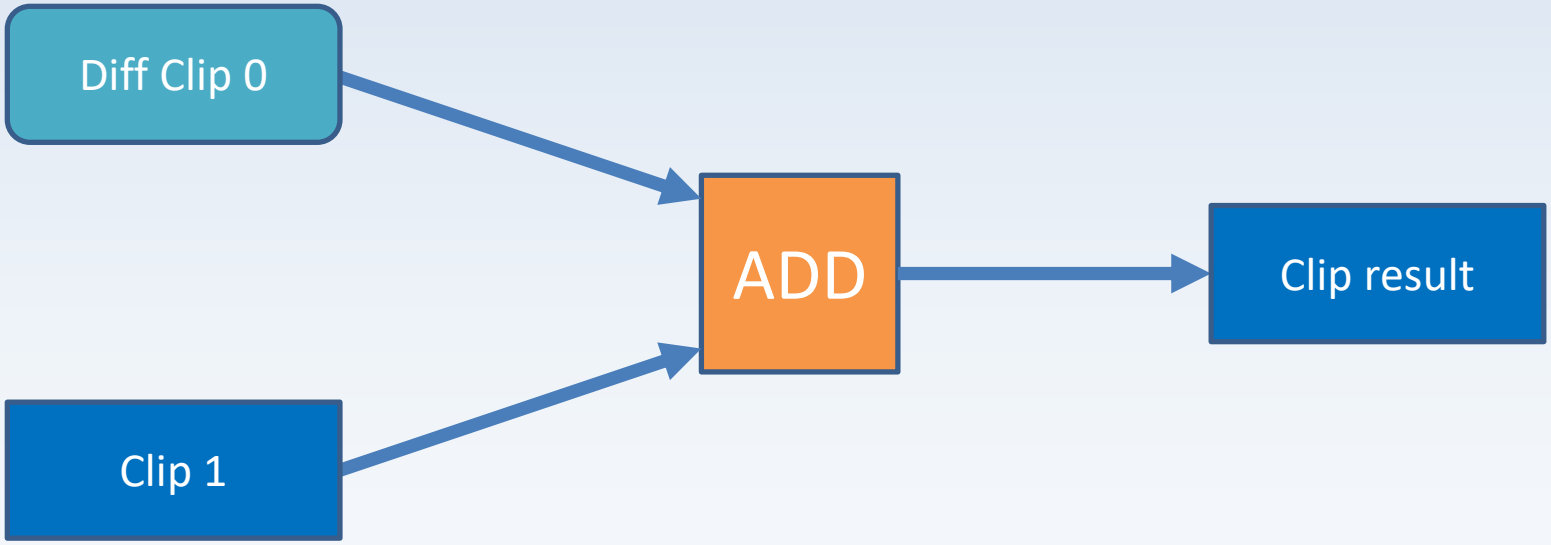
Initial inputs are all *key poses*

First set of LERPs results in the *intermediate poses*



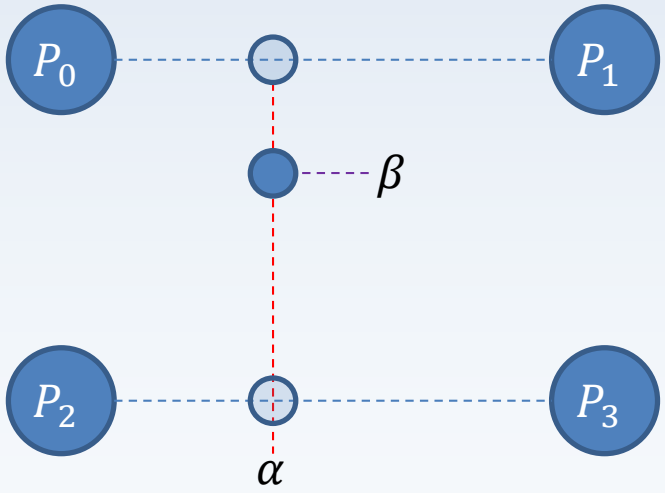
Animation Blending: Blend Trees

- ***Additive animation*/*Layered animation***:
- Inputs are *clip* and *diff clip*, or multiple diffs



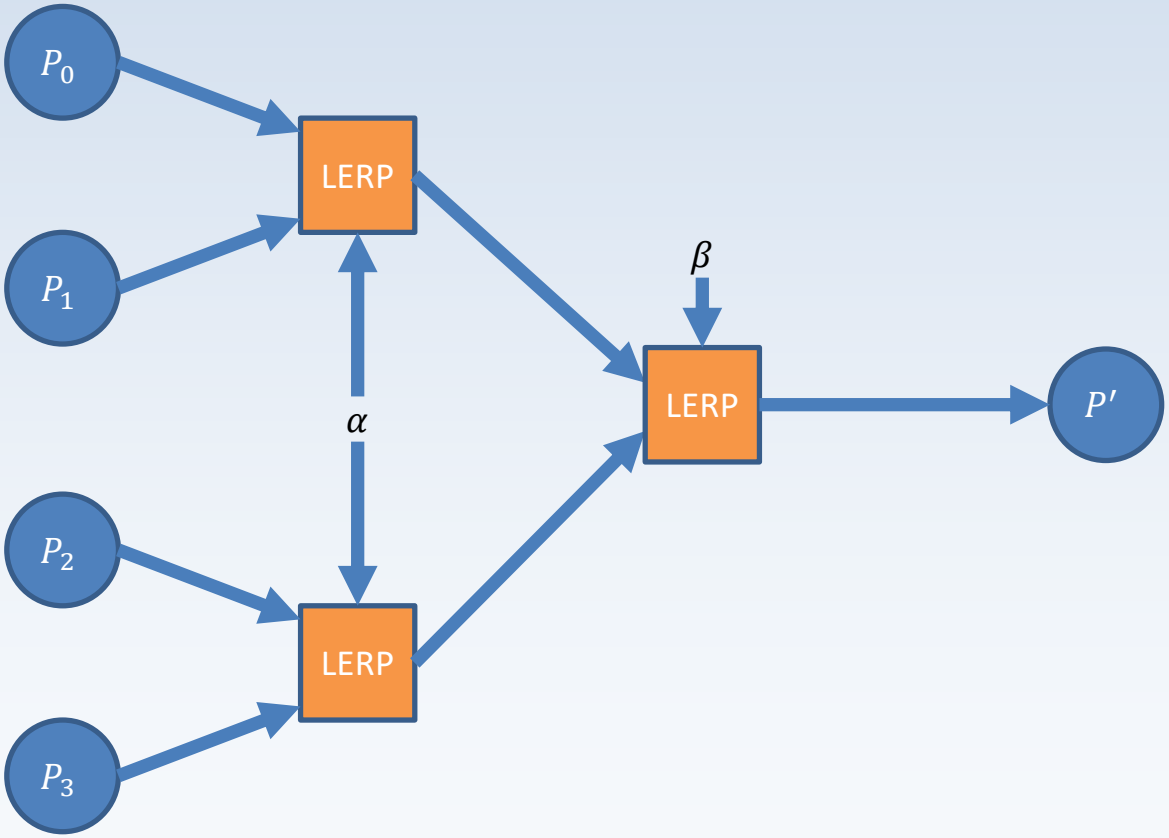
Advanced Blend Operations

- Clip blending is, at minimum, a tree with two layers of LERP… what if using just *one* alpha?
- ***Bi-linear interpolation*** (“BiLERP”)



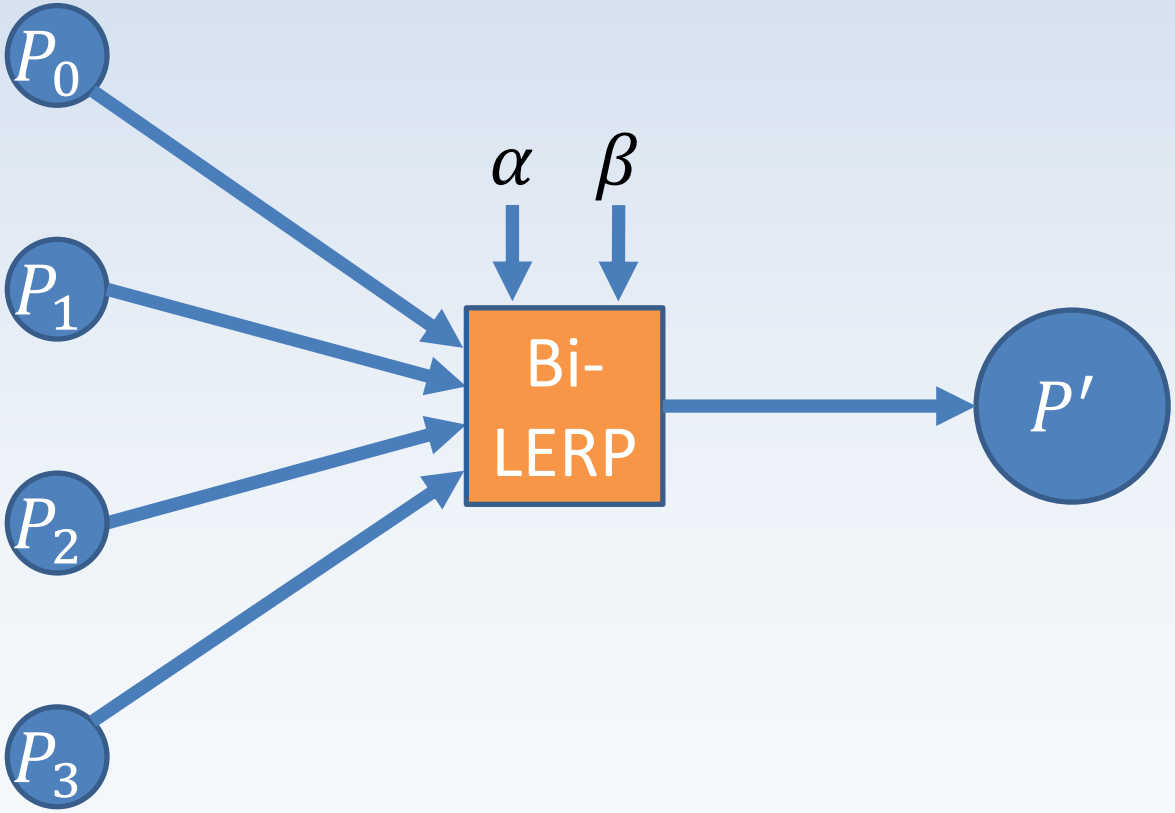
Advanced Blend Operations

- ***Bi-linear interpolation*** (“BiLERP”)



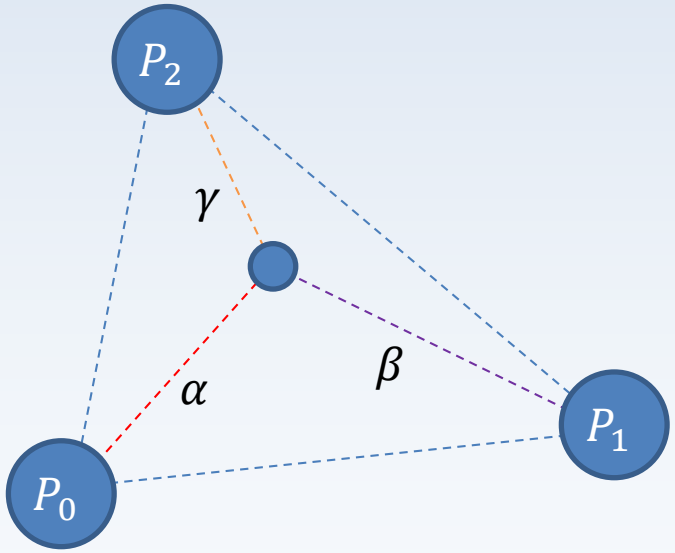
Advanced Blend Operations

- ***Bi-linear interpolation*** ("BiLERP")



Advanced Blend Operations

- ***Triangular LERP***: Calculated by taking a weighted average of 3 samples, uses 2 params
- *Barycentric coordinates*:

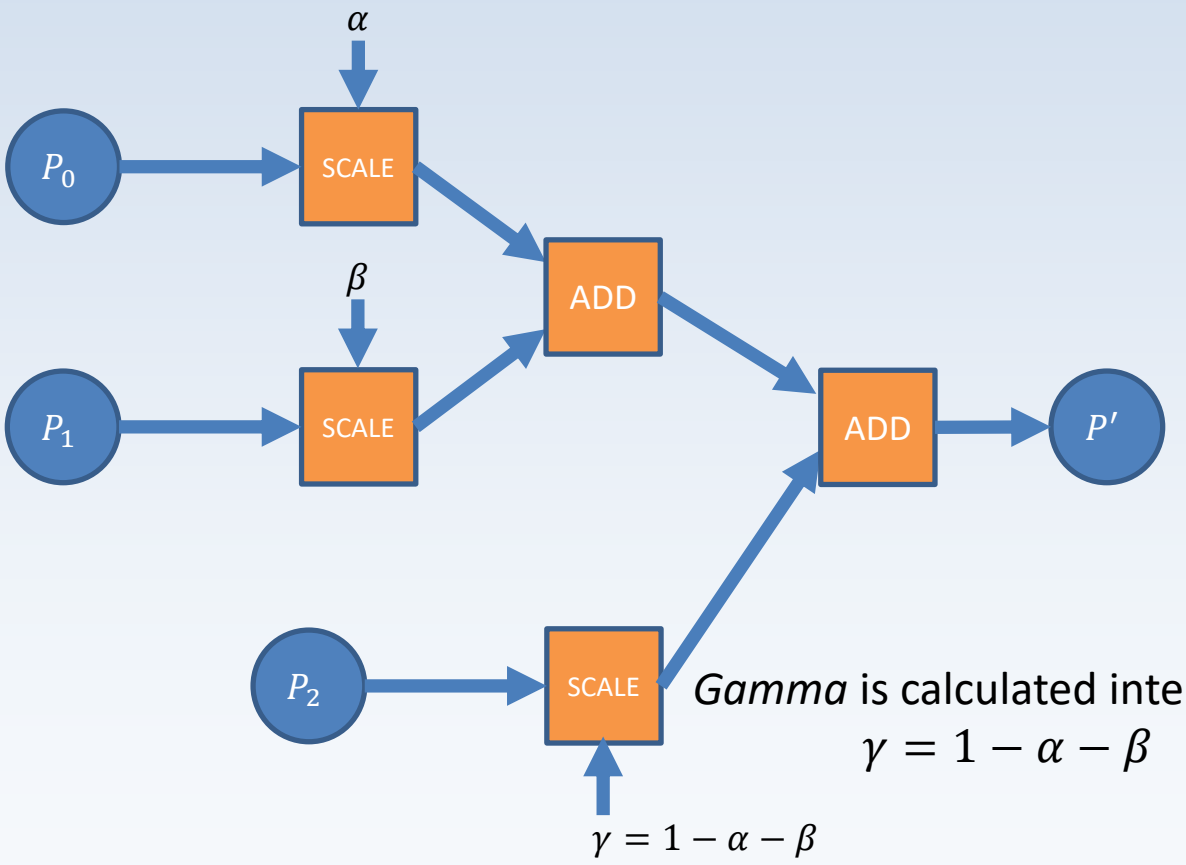


Given α and β
(note: different context from prior uses of these variables!!!):

$$\gamma = 1 - \alpha - \beta$$

Advanced Blend Operations

- ***Triangular LERP***: basically a weighted average

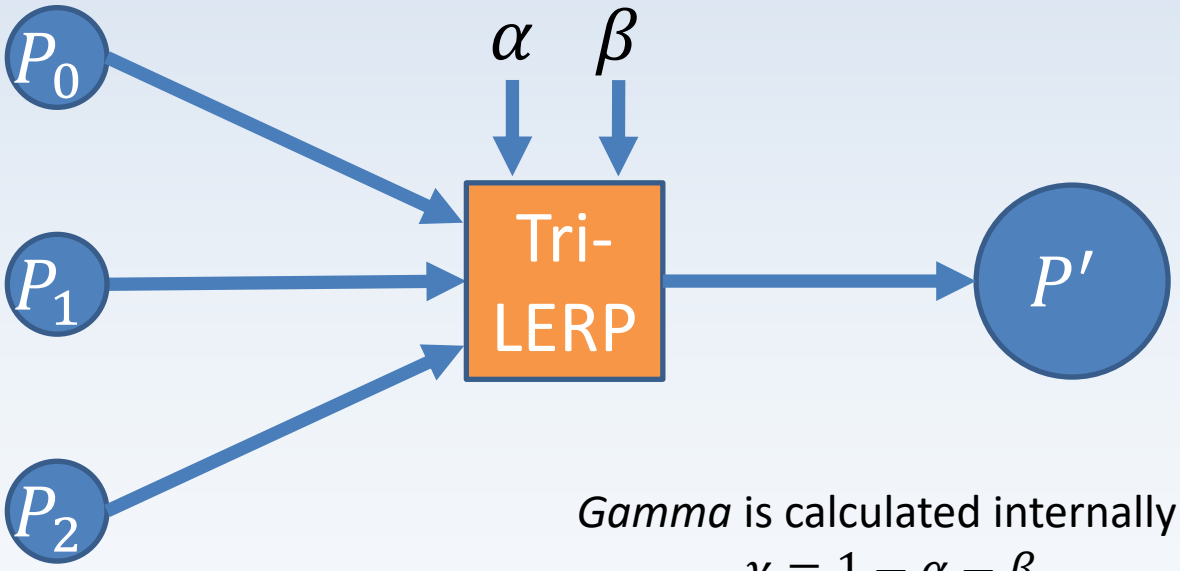


Gamma is calculated internally:

$$\gamma = 1 - \alpha - \beta$$

Advanced Blend Operations

- ***Triangular LERP***:



Gamma is calculated internally:

$\gamma = 1 - \alpha - \beta$

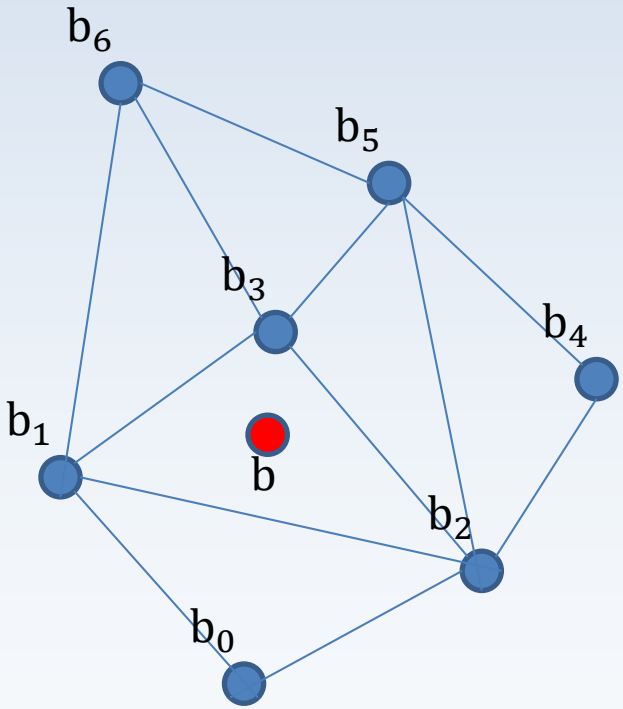
Advanced Blend Operations

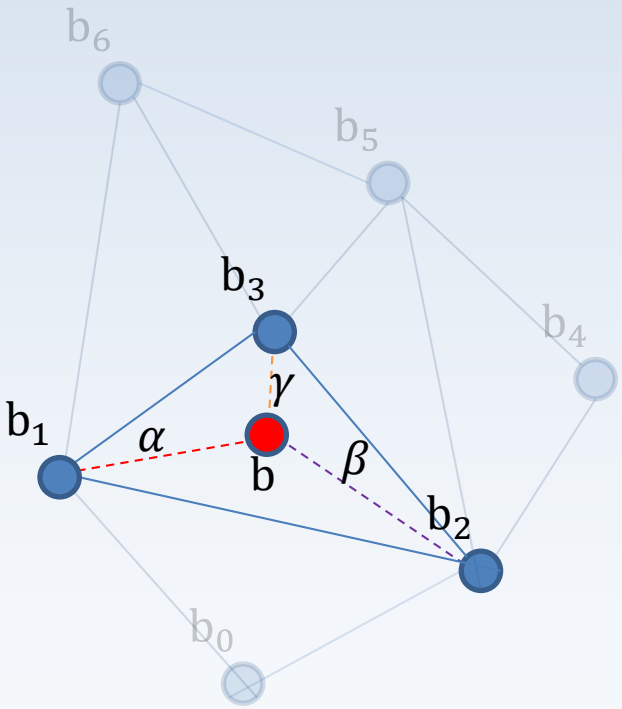
- ***Delaunay LERP***: complex extension of triangular LERP
- Use *Delaunay triangulation* to determine where the sample lies relative to others
- Actually requires a *spatial abstraction of poses* as if they were a graph of points on a plane…
- …we triangulate the result and use the parameters for triangular LERP

Advanced Blend Operations

- ***Delaunay LERP***: treat poses as graph nodes

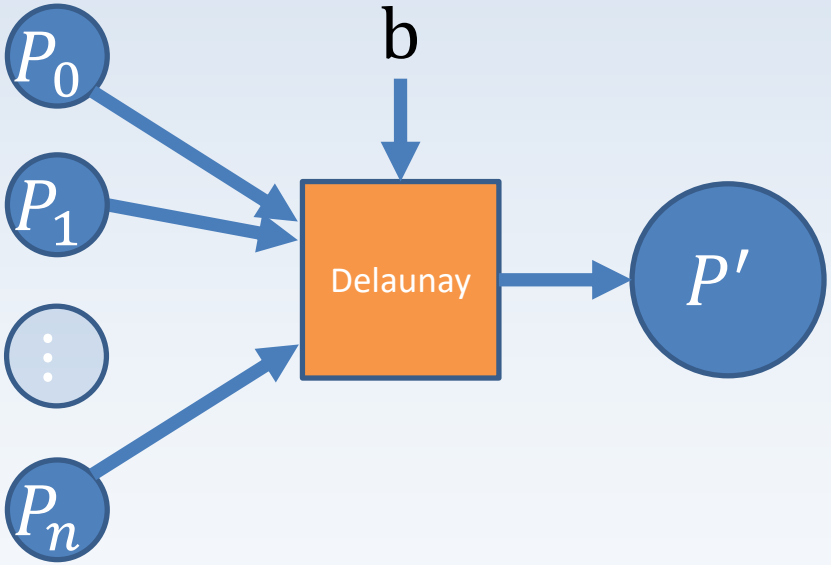
$\text{Delaunay}_{b_0 \ldots b_6}(b)$: calculates *alpha*, *beta* and *gamma*

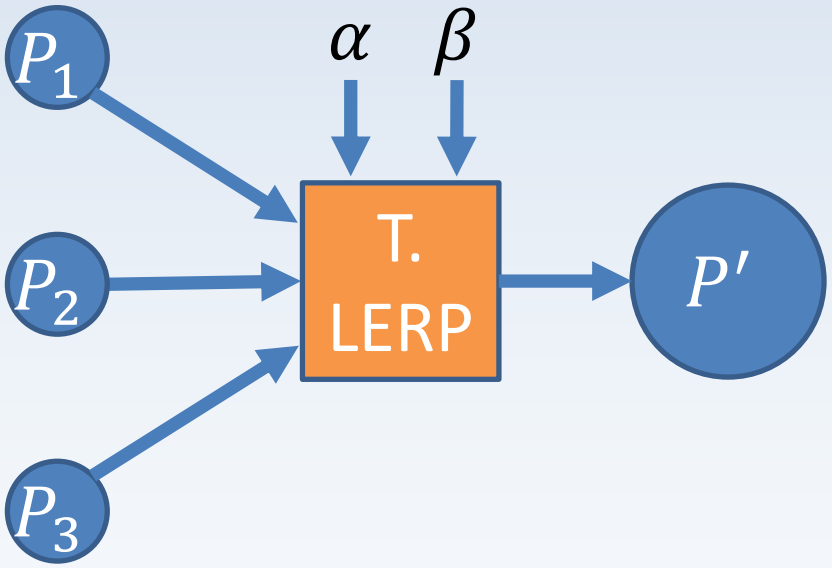




Advanced Blend Operations

- ***Delaunay LERP***: boils down to a triangulation





Indices 1-3 are from example on previous slide; the point ‘b’ lies within influences b0, b1, b2

Advanced Blend Operations

- ***Delaunay LERP***: useful for…
- …spontaneous changes in animation clips
- …not knowing what will happen
- …control
- …limited animation data (i.e. procedural)

- Check out “Overgrowth”
  - https://www.youtube.com/watch?v=LNidsMesxSE

The end.

- Questions? Comments? Concerns?