

Melody → String Arrangement with Rule-guided Seq2Seq Transformer

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The diagram illustrates the process of converting a monophonic melody into a multi-track string arrangement. On the left, a single melodic line in G major (one sharp) and common time (C) is shown. The melody starts with a half note G4, followed by quarter notes A4, B4, and C5, and ends with a quarter rest. The dynamic marking *p* (piano) is placed below the first note. A large black arrow points from this melody to a multi-track string arrangement on the right. The arrangement consists of seven staves: Violin Solo, Violin 1, Violin 2, Viola, Violoncello, and Contrabass. The Violin Solo part is marked *espressivo* and plays the melody with a slur. Violin 1 and Violin 2 are marked *p con sordino* and play sustained chords. Viola is marked *pp con sordino* and plays sustained chords. Violoncello and Contrabass are marked *p pizz. con sordino* and play pizzicato chords. The Viola part includes a *div.* (divisi) marking in the fourth measure. The overall dynamic marking *p* is placed below the Contrabass staff.

I want to use a Transformer Model to create an algorithm that takes a monophonic melody as input, and renders a multi-track string arrangement as output.

- Core challenge: Joint modelling of vertical harmony (**voicing**)
+ instrument-idiomatic, horizontal smooth lines (**voice-leading**).
- Melody instrument should be Violin, with the rest of the parts playing accompaniment. So called *divisi* can be used to split up into further sub-parts: {vln1a, vln1b, vln2a, vln2b, ...}

Data & Modelling

- **Dataset: PDMX** (large-scale public-domain MusicXML)
Train on *broad polyphonic textures* (strings, winds, choir, piano) to maximize data.
- **Supervision:** Extract **melody = top-line**. Remaining voices become **accompaniment**.
Optionally allow *divisi*/doublings.
- **Neural model:** Transformer encoder–decoder (Seq2Seq)
Transformer takes one sequence as input (the melody) and generates another sequence as output (the arrangement). The encoder-decoder structure reads and summarizes the melody into an internal representation, and generates the accompaniment step by step.
- **Must have-constraints:** instrument ranges, no voice crossing, avoid impossible jumps.
- **Nice-to-haves:** penalize awkward leaps; reward things like open strings on long notes or strong beats.
The idea is that even if the model learns “general polyphony” from lots of data, the final output is guided toward something that is idiomatic and playable for strings.

Evaluation and Timeline

- **Evaluation:** voice-leading metrics (leaps/range/crossing) + string-idiomaticity (open-string rate, low-register density) + qualitative MIDI/score examples. **Visual inspection by musicians.**
- **Timeline:**
 - **Feb:** Data inspection, parsing + filtering (strings / top-line extraction), dataset pipeline
 - **Mar:** baseline + metrics pipeline
 - **Apr:** Transformer training
 - **May:** Additional constrained decoding + evaluation/ablations
 - **Jun:** write-up + demos