Karyoview: a novel comprehensive ideogram generator website integrated with Chromamind (AI) for chromosomal rearrangements in malignancies including hematologic malignancies

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Background: Chromosomal rearrangements are very common in hematological malignancies. Defining the novel derivative chromosome is essential for interpretation of fusion genes but frequently necessitates drawing ideograms to compare.

Purpose: We aimed to instruct a website that quickly creates ideograms for enormous chromosomal rearrangements. Methods: Chromosomal cytobands were defined according to ISCN: An International System for Human Cytogenomic Nomenclature and NCBI Genome Decoration Project ISCN ideograms based on the GRCh38/hg38 assembly at 400-, 550-, and 850-band resolutions. A custom computer-based cytogenomic software framework, KaryoView Chromosome Simulation Engine was developed to model chromosome structure and rearrangements. Karyoview uses smart algorithms and interactive modules to represent each chromosome and cytobands. An AI-assisted educational module, Chromamind, was integrated into the KaryoView framework. Chromamind is based on a large language model and uses strict JSON validation to convert natural language input into structured commands. The front end was developed using TypeScript and Vue with SVG-based chromosome rendering. The backend was implemented with Python and FastAPI, supported by PostgreSQL persistence and a curated bilingual English–Turkish cytogenomics knowledge base.

Results: We built www.karyoview.com website and created our own AI support system called “Chromamind”. Chromosomal rearrangements such as deletion, inversion, duplication, isochromosome, translocation and even with jumping translocation were able to be generated either manual or other modes (ai, lab, karyotype, etc.). Breakpoints can be placed either at cytoband level or at base-pair resolution using an interactive draggable cursor, allowing precise breakpoint fine-tuning.

Conclusions: We successfully established a comprehensive in-silico ideogram generator program working with our own AI for entire chromosomal tesrrangements. We further proposed to launch a module where users can upload their own microscope images for automated diagnostic support to generate ideograms from karyotype images.

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