AI-Powered Knowledge Graph to Manim Animation Automation

Pseudo-Code Explanation

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1. Main Program Flow

```
START

INPUT: user_query (e.g., "Explain Binary Trees")

CALL retrieve_concept_from_KG(user_query) → concept_data

CALL generate_slides_and_script(concept_data) → slides, script

CALL format_content(slides, script) → formatted_storyboard

CALL generate_manim_code(formatted_storyboard) → manim_code

CALL render_video_with_manim(manim_code) → video_output

CALL add_audio_and_captions(video_output, script) → final_video

OUTPUT: final_video (MP4)

END
```

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2. Knowledge Graph Retrieval

```
FUNCTION retrieve_concept_from_KG(query):
    CONNECT to KnowledgeGraph
    SEARCH for concept node matching query
    FETCH related subtopics + definitions
```

```
    RETURN concept_data
```

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3. AI Content Generation

```
FUNCTION generate_slides_and_script(concept_data):
    PROMPT AI with concept_data
    CREATE structured slides:
        - Title
        - Bullet Points
        - Diagrams
    CREATE narration script
    RETURN slides, script
```

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4. Formatting Layer

```
FUNCTION format_content(slides, script):
    CONVERT slides into storyboard structure
    CLEAN text, ensure readability
    ADD metadata (timing, animations, visual hints)
    RETURN formatted_storyboard
```

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5. Manim Automation

```
FUNCTION generate_manim_code(storyboard):
    FOR each slide IN storyboard:
        MAP slide type → Manim scene template
        CREATE Manim code block
    COMBINE all blocks into single manim_code
    RETURN manim_code
```

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6. Rendering & Output

```
FUNCTION render_video_with_manim(manim_code):
```

```
    EXECUTE manim_code using Manim engine
    SAVE output as MP4
    RETURN video_output

FUNCTION add_audio_and_captions(video, script):
    GENERATE narration audio (TTS) from script
    MERGE video + audio + captions
    RETURN final_video
```